TM 5-687

WAR DEPARTMENT TECHNICAL MANUAL

INSPECTION and PREVENTIVE MAINTENANCE SERVICES FOR

FIRE-PROTECTION EQUIPMENT and APPLIANCES

WAR DEPARTMENT • JANUARY 1946

TECHNICAL MANUAL

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CHANGES No. 1

WAR DEPARTMENT
WASHINGTON 25, D. C., 24 September 1946

TM 5-687, 15 January 1946, is changed as follows:

Figure 11

Fire extinguisher tag

Figure 12 is rescinded.

32. Form.

Record tag, WD AGO Form 253 (fig. 11) is printed in two colors: green for carbon dioxide gas extinguishers and buff for all other types. The following information is recorded:

* * * * * * *

[AG 300.7 (13 Sep 46)]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:
EDWARD F. WITSELL
Major General
The Adjutant General

DWIGHT D. EISENHOWER
Chief of Staff

DISTRIBUTION:
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For explanation of distribution formula, see FM 21-6.

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TM 5-687

INSPECTION and PREVENTIVE

MAINTENANCE SERVICES FOR

FIRE-PROTECTION

EQUIPMENT and APPLIANCES

WAR DEPARTMENT • JANUARY 1946

United States Government Printing Office
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WAR DEPARTMENT
WASHINGTON 25, D. C., 15 January 1946

TM 5–687, Inspection and Preventive Maintenance Services for Fire-protection Equipment and Appliances, is published for the information and guidance of all concerned.

[AG 300.7 (12 Dec 45)]

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Acting The Adjutant General

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Refer to FM 21–6 for explanation of distribution formula.

CONTENTS

CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual is written to help post fire department personnel to keep fire-fighting equipment and appliances in serviceable condition. It outlines procedures for preventive maintenance inspections and services and described methods of keeping inspection and maintenance records.

b. Instructions in this manual do not apply to leased equipment or equipment obtained by special arrangements with municipalities. Instructions cover only equipment and appliances owned by the War Department and installed or maintained for fire protection purposes under Repairs and Utilities program. For detailed information on the responsibilities for fire protection, see TM 5–600. Principles contained herein may be applied as appropriate to similar equipment used for fire protection purposes at War Department installation or by military troop units.

2. Command Inspections

a. PURPOSE. Command inspections, as functions of commanding officers, are made to determine the general condition of fire department equipment, ability of personnel to operate the equipment, cases of neglect or carelessness, and need for additional personnel instruction or training. To evaluate the performance of fire equipment and operating personnel properly, observation at time of fire is essential. However, periodic command inspections in quarters or under test conditions often reveal conditions which can be effectively corrected before fire occurs.

b. PROCEDURE. Command inspections may be either informal or spot checks. They can be made at any time, preferably without previous notification. Spot checks involving actual tests of representative equipment are particularly effective because they permit observation under operating conditions. Informal and spot-check inspections cover—

(1) Cleanliness of station and equipment.

(2) Operating condition of representative pieces of equipment, selected at random.

(3) Alertness, general knowledge, ability, and discipline of personnel.

(4) Condition and completeness of records.

3. Technical Inspections

The fire chief is responsible for the technical efficiency of the fire apparatus and equipment. As part of that responsibility, he makes periodic technical inspections to determine the condition of apparatus and equipment, effectiveness of first- and second-echelon maintenance, to assure continued operation and need for additional instruction or training of personnel in proper operation and care of equipment. These inspections may be made without previous notification. Corrective action is directed for any defects noted. The fire marshal, as administrative head of the fire department, makes certain the fire chief is performing his assigned responsibilities.

4. Service Command Inspections

Service command technical personnel make periodic inspections to determine the effectiveness of first- and second-echelon preventive maintenance inspections, to familiarize personnel with proper operating and preventive maintenance practices, and to insure uniform procedures at all posts as indicated in paragraph 1*b*. They inspect all apparatus and equipment at least every 6 months; more frequent inspections are desirable if activities and importance of the facilities warrant. Operating personnel help in the inspection so their performance can be observed at the same time.

a. PROCEDURE. (1) Examine the following preventive maintenance records:

(*a*) WD AGO Form 461.

(*b*) Previous WD AGO Form 5–5.

(*c*) Hose records.

(*d*) Fire-extinguisher records.

(*e*) Daily maintenance records.

(*f*) Training records.

(2) Inspect apparatus and equipment and check current WD AGO Form 5–5.

(3) Immediately correct deficiencies within their scope.

(4) Arrange for and expedite correction of major deficiencies.

(5) Check proficiency of operating personnel.

(6) Give instructions in operation or preventive maintenance when indicated.

(7) Spot-check fire extinguishers throughout the post.

b. RECORDS. The service command establishes and maintains suitable records of inspections made, including listings of equipment inspected, findings, and other pertinent data. Records are kept on file at the post to which they apply.

CHAPTER 2

MOTORIZED FIRE APPARATUS AND AUXILIARY PUMPING EQUIPMENT

Section I. GENERAL

5. Scope

This chapter describes apparatus issued by the Corps of Engineers for fighting fires at Army posts, and outlines general inspection and preventive maintenance procedures. This chapter, appropriate War Department Technical Manuals, and the manufacturer's manual usually issued with fire apparatus supplement each other and should be used together.

6. Safety

The safety of fire-fighting personnel riding on fire apparatus depends on the reliability of parts designed for safety, such as handrails, running boards, step plates, and individual grab handles. To prevent accidents, those parts must be kept in good condition at all times.

Section II. TYPES OF FIRE APPARATUS

7. General

Because of the variety of fire-fighting problems at Army posts, several types of Army fire apparatus are provided. They include truck-, trailer-, and skid-mounted units with capacities ranging from 300 to 750 gallons per minute (gpm).

a. PERFORMANCE STANDARDS. The principal requirement for fire apparatus is dependability. Fast acceleration is desirable and considerable reserve power necessary. High road speed, however, is objectionable because of the danger of accidents. Pumps must be able to provide adequate continuous pressure under conditions for which they were designed. Other equipment carried on the apparatus must be able to function safely and satisfactorily under operating conditions. To insure proper performance, all apparatus issued by the Corps of Engineers is subjected to the pumping standards set by the National Board of Fire Underwriters.

b. CHARACTERISTICS. Specific characteristics of each type of fire apparatus are discussed in paragraphs 8 through 10.

8. Truck-mounted Apparatus

a. GENERAL. (1) *Chassis.* Truck-mounted fire apparatus may have a military or commercial type chassis. The military type is specially designed to meet the needs of military service. It is used for smaller types of apparatus and is assigned to areas where roads may be bad and cross-country travel necessary. The commercial type chassis is a standard commercial truck chassis adapted to fire service by addition of a fire pump and special fire department body, or of a type built specifically for fire service.

(2) *Equipment.* Both types are equipped with a pump, water tank, hose body, and miscellaneous fire-fighting equipment. A specially designed cooling system permits pump and motor to operate for long periods without overheating. A relief valve or pressure regulator on the pump permits flexible operation required to meet changing fire-fighting needs. Army fire apparatus usually carries a 14-foot roof ladder and a 24- or 36-foot extension ladder and also carries a standard assortment of nozzles, forcible-entry tools, and other items to meet normal fire-fighting needs. Special equipment can be requisitioned only if there are unusual needs.

b. CLASS 750 FIRE TRUCK. The class 750 fire truck (fig. 1), the largest pumping unit supplied by the Corps of Engineers, is the same general type as apparatus found in municipal fire departments. Because of its large capacity, 750 gpm assignment, is normally confined to major installations where large quantities of water and powerful streams are needed. The unit consists of a 4x2 truck with 150- to 200-horsepower (hp) engine carrying a midship-mounted fire pump, a booster water tank, hose body, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–15.

(1) *Pump.* Water pressure is provided by a centrifugal or rotary-gear pump driven by a special gear train or transfer unit from the vehicle engine. It can supply three 2½-inch hose lines. Total pump capacity varies with pressure as follows:

(*a*) 750 gpm at 120 pounds net pump pressure.
(*b*) 375 gpm at 200 pounds net pump pressure.
(*c*) 250 gpm at 250 pounds net pump pressure.

(2) *Booster water tank.* The booster water tank is mounted in the front end of the hose body and is permanently piped to the suction side of the pump. Its capacity is 150 gallons.

(3) *Hose.* The hose body can hold 1,000 feet of 2½-inch double-jacketed hose. In addition, the apparatus has 150 feet of 1-inch booster hose permanently attached to the discharge side of the pump. This hose may be carried on a reel or in a basket.

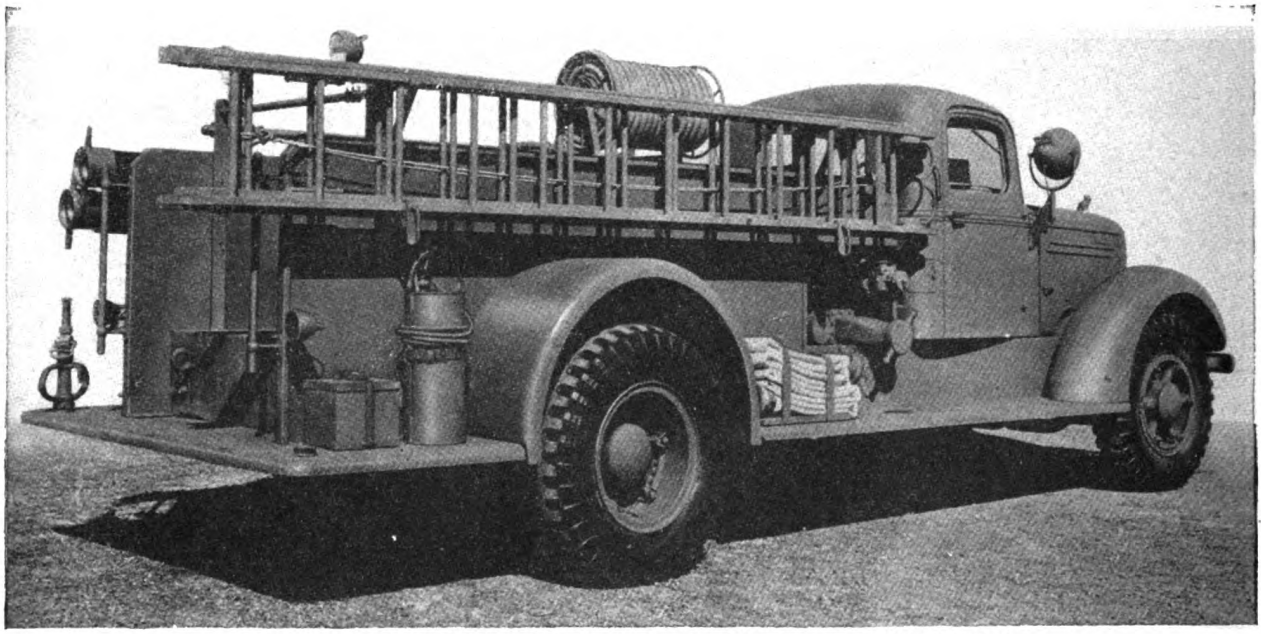

Figure 1. Class 750 fire truck, 4 x 2 chassis. (Stock No. 58-9120.952-750.)

c. CLASS 525 FIRE TRUCK. The class 525 fire is issued on a 4x2 (fig. 2) or 4x4 (fig. 3) chassis with a 90- to 110-hp engine. It carries a front-mounted 500-gpm capacity pump, a booster tank, hose body, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–14.

(1) *Pump.* The centrifugal type pump is driven by a special floating propeller shaft connecting with the front end of the engine crankshaft. A conventional clutch engages and disengages the pump. There is no special transmission; the pump is driven at engine speed. It can supply two 2½-inch hose lines. Capacity varies with pressure as follows:

(*a*) 500 gpm at 120 pounds net pump pressure.
(*b*) 250 gpm at 200 pounds net pump pressure.
(*c*) 167 gpm at 250 pounds net pump pressure.

(2) *Booster water tank.* The booster water tank has a capacity of 150 gallons. It is located in the forward end of the hose body and is piped to the discharge side of the pump.

(3) *Hose.* The hose body can hold 1,000 feet of 2½-inch double-jacketed hose. The truck also carries 150 feet of booster hose permanently attached to discharge side of pump.

d. CLASS 500 FIRE TRUCK. The class 500 fire truck (fig. 4) is the unit most commonly used at Army installations. It is similar to the class 750 truck but is smaller and has less pump capacity. The truck has a 4x2 chassis and a 90- to 110-hp engine. It carries a midship-mounted 500-gallon pump, a booster water tank, hose body, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–14.

(1) *Pump.* The pump, which may be centrifugal or rotary-gear type, is driven by a transfer unit from the vehicle engine. It can supply two 2½-inch hose lines within the following limits of capacity and pressure:

(*a*) 500 gpm at 120 pounds net pump pressure.
(*b*) 250 gpm at 200 pounds net pump pressure.

(*c*) 167 gpm at 250 pounds net pump pressure.

(2) *Booster water tank.* A 150-gallon booster tank is mounted in the forward end of the hose body and is permanently piped to the suction side of the pump.

(3) *Hose.* The hose body can hold 1,000 feet of 2½-inch double-jacketed hose. In addition, 150 feet of 1-inch booster line is attached to the discharge side of the pump. The booster hose may be carried on a reel or in a hose basket.

e. CLASS 325 FIRE TRUCK. The class 325 fire truck is designed for use where the water supply and distribution system is limited. It is issued on a 4x2 (fig. 5) or 4x4 (fig. 6) chassis with a platform type body and a 90- to 110-hp engine. It has a front-mounted 300-gpm pump, a booster water

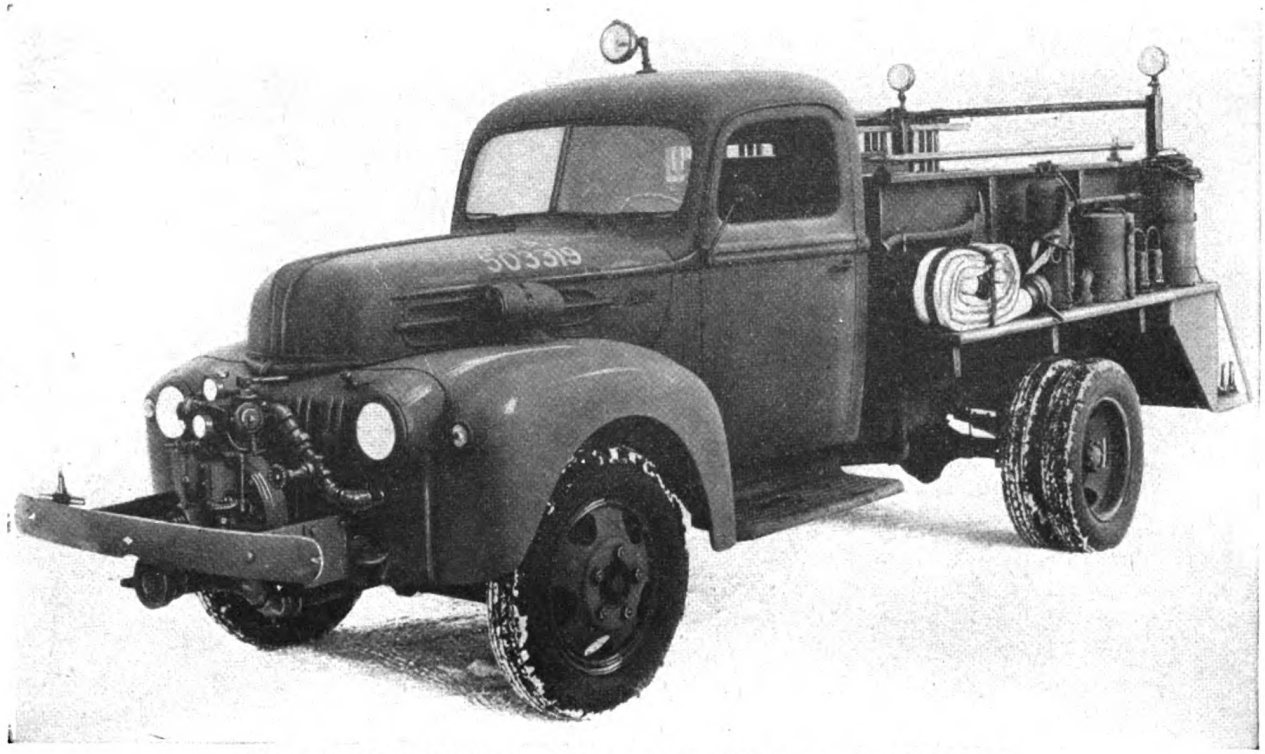

Figure 2. Class 525 fire truck, 4 x 2 chassis. (Stock No. 58-9120.920-525.)

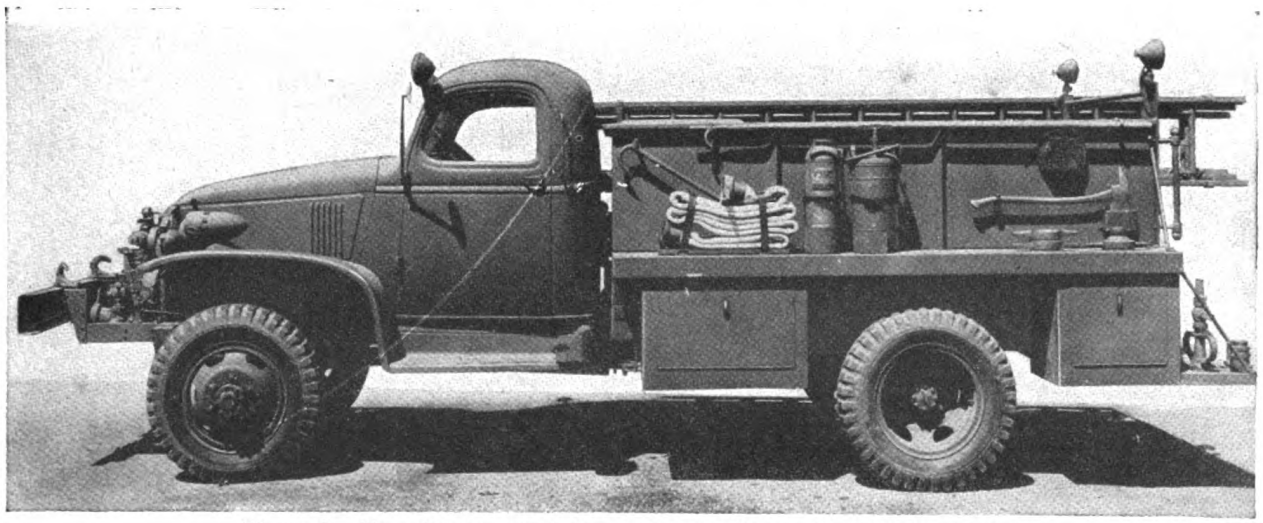

Figure 3. Class 525 fire truck, 4 x 4 chassis. (Stock No. 58-9120.922-525)

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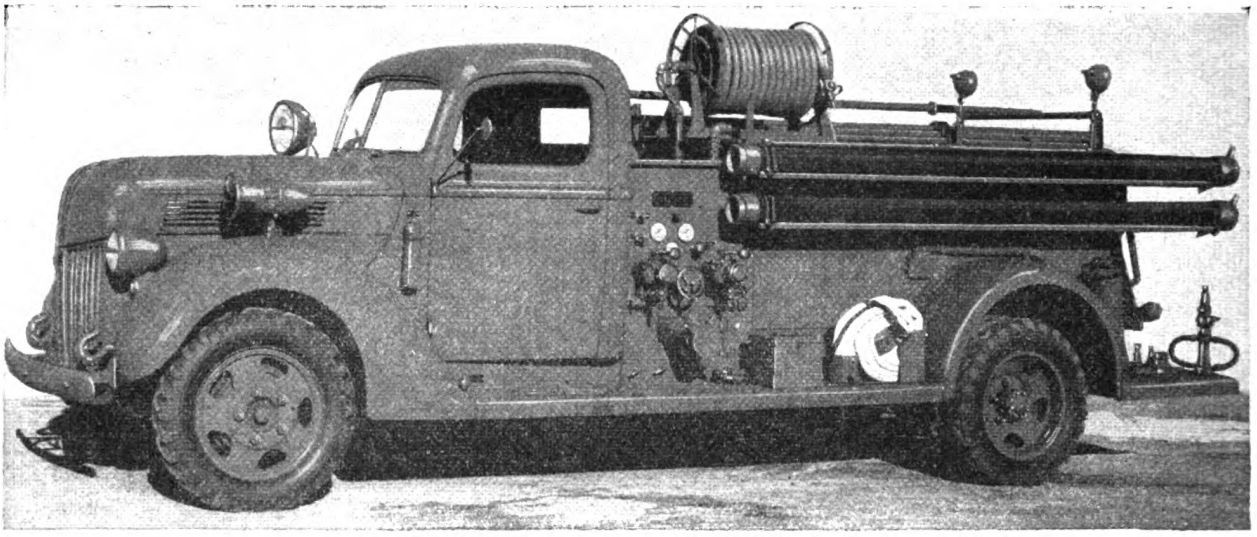

Figure 4. Class 500 fire truck, 4 x 2 chassis. (Stock No. 58–9120.915–500.)

tank, hose body, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–12. The class 325 fire truck may also be equipped and used as a brush or forestry fire truck in lieu of the class 300 fire truck. (See *f* below.)

(1) *Pump.* The single-stage centrifugal pump is driven by a special floating propeller shaft connecting with the front end of the engine crank shaft. The pump is engaged or disengaged by a conventional clutch. It does not have a special transmission, and is driven at engine speed. The pump can supply one 2½-inch hose line or two 1½-inch lines. Capacity varies with pressure as follows:

(*a*) 300 gpm at 120 pounds net pump pressure.

(*b*) 150 gpm at 200 pounds net pump pressure.

(2) *Booster water tank.* The booster water tank is L-shaped and has a capacity of 300 gallons. It is mounted on the platform type body and piped to the suction side of the pump.

(3) *Hose.* The sides of the booster tank are extended to form a hose body which can hold 600 feet of 2½-inch double-jacketed hose. Two hose reels, each carrying 150 feet of 1-inch rubber booster hose, are permanently attached to the discharge side of the pump.

f. CLASS 300 FIRE TRUCK. The class 300 fire truck is supplied primarily to posts that might be subject to forest or brush fires. It is issued on a

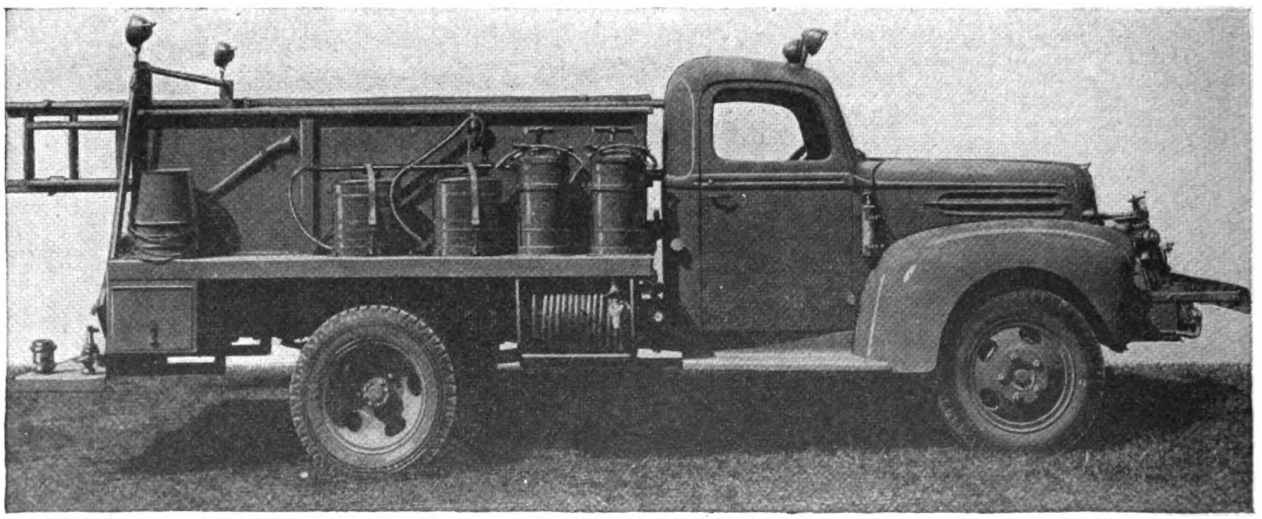

Figure 5. Class 325 fire truck, 4 x 2 chassis. (Stock No. 58–9120.909–325.)

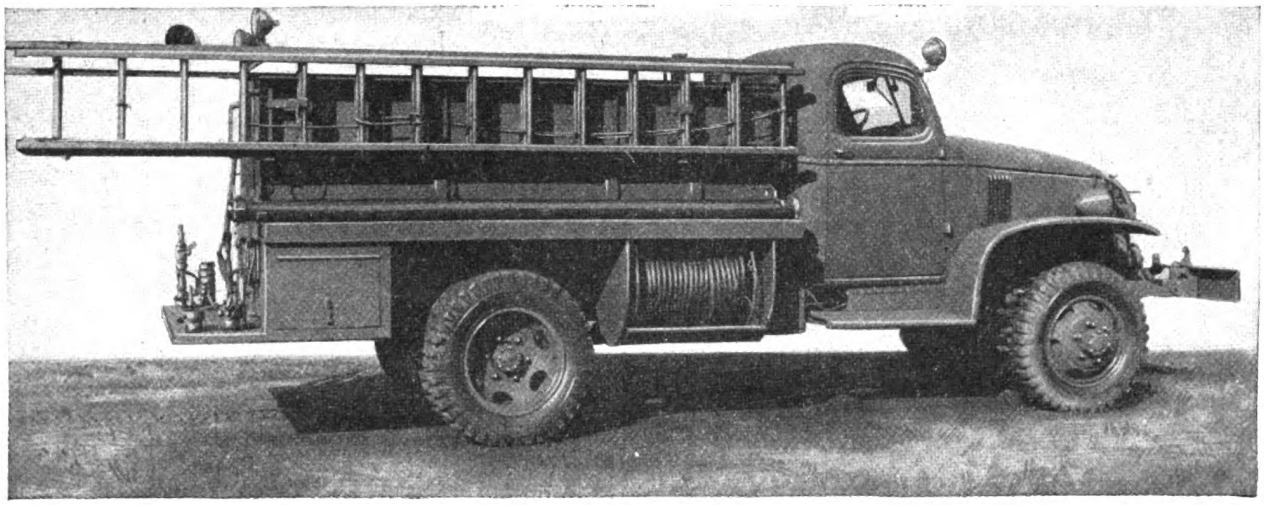

Figure 6. Class 325 fire truck, 4 x 4 chassis. (Stock No. 58–9120.910–325.)

4x2 (fig. 7) or 4x4 (fig. 8) chassis with a platform type body and a 90- to 110-hp engine. It carries a front-mounted 300-gpm pump, a booster water tank, hose body, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–11.

(1) *Pump.* The pump is the same type and has the same capacity as that on the class 325 fire truck. It can supply two 1½-inch hose lines within the limits of pump capacity.

(2) *Booster water tank.* The booster tank is mounted in the forward end of the hose body and is piped to the suction side of the pump. Its capacity is 250 gallons.

(3) *Hose.* The hose body can hold 1,000 feet of

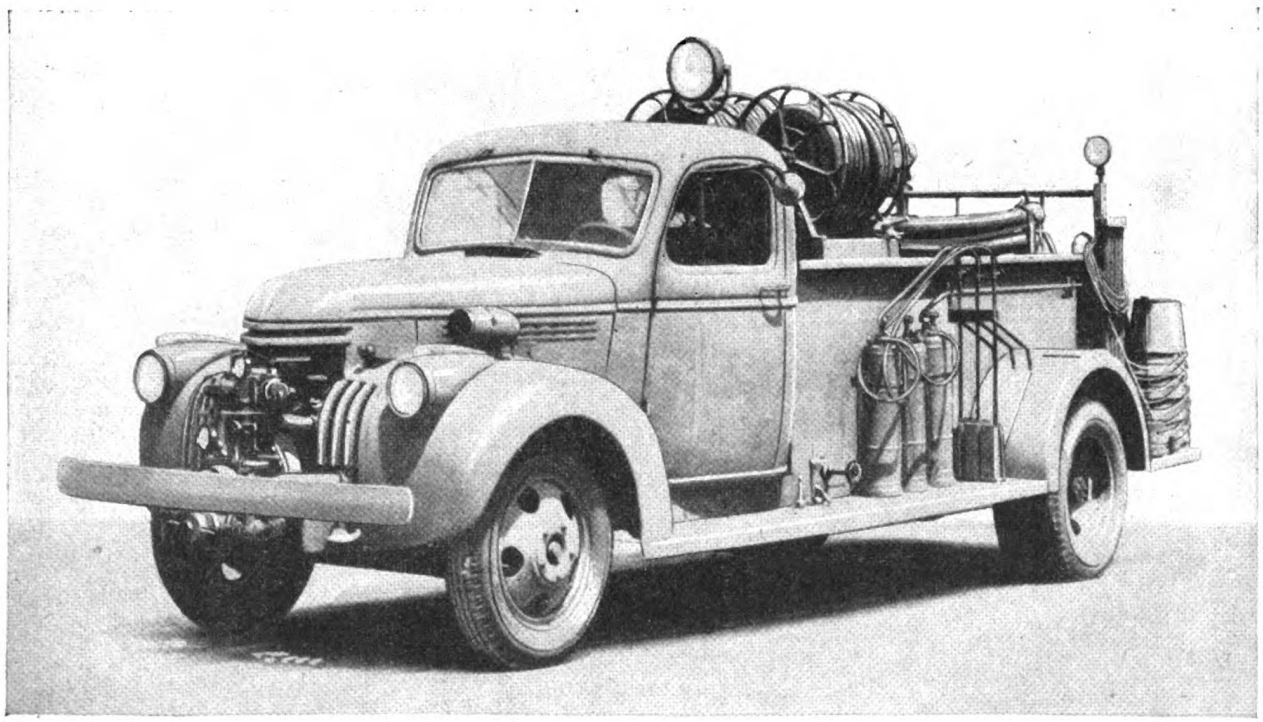

Figure 7. Class 300 brush fire truck, 4 x 2 chassis. (Stock No. 58–9120.300–300.)

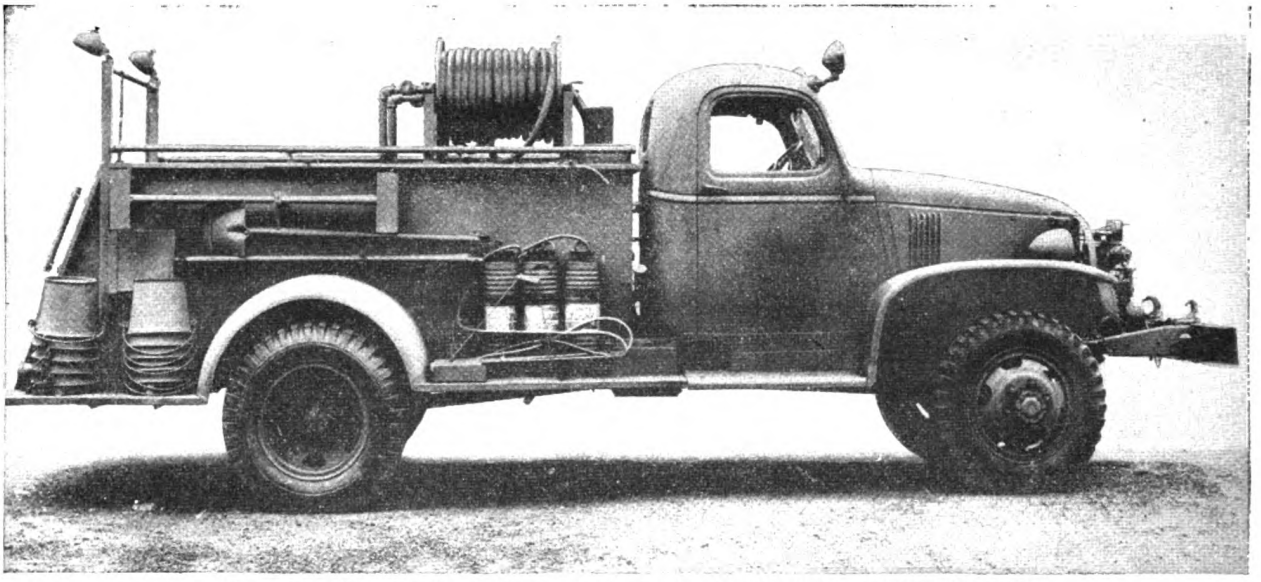

Figure 8. Class 300 brush fire truck, 4 x 4 chassis. (Stock No. 58–9120.301–300.)

1½-inch double-jacketed hose. Two reels carry the same amount of booster hose as the class 325 truck.

9. Trailer-mounted Apparatus

The class 1000 trailer (fig. 9) is the only fire-fighting trailer unit issued by the Corps of Engineers. It is designed as an auxiliary pumper and is issued to warehouses, hospitals, posts, storage depots, and similar installations for added protection in extreme emergencies. The unit consists of a two-wheel trailer carrying a self-contained 500-gpm pump, hose, and standard fire-fighting equipment prescribed in Set Number ENG 6 485–16. It does not have a booster water tank.

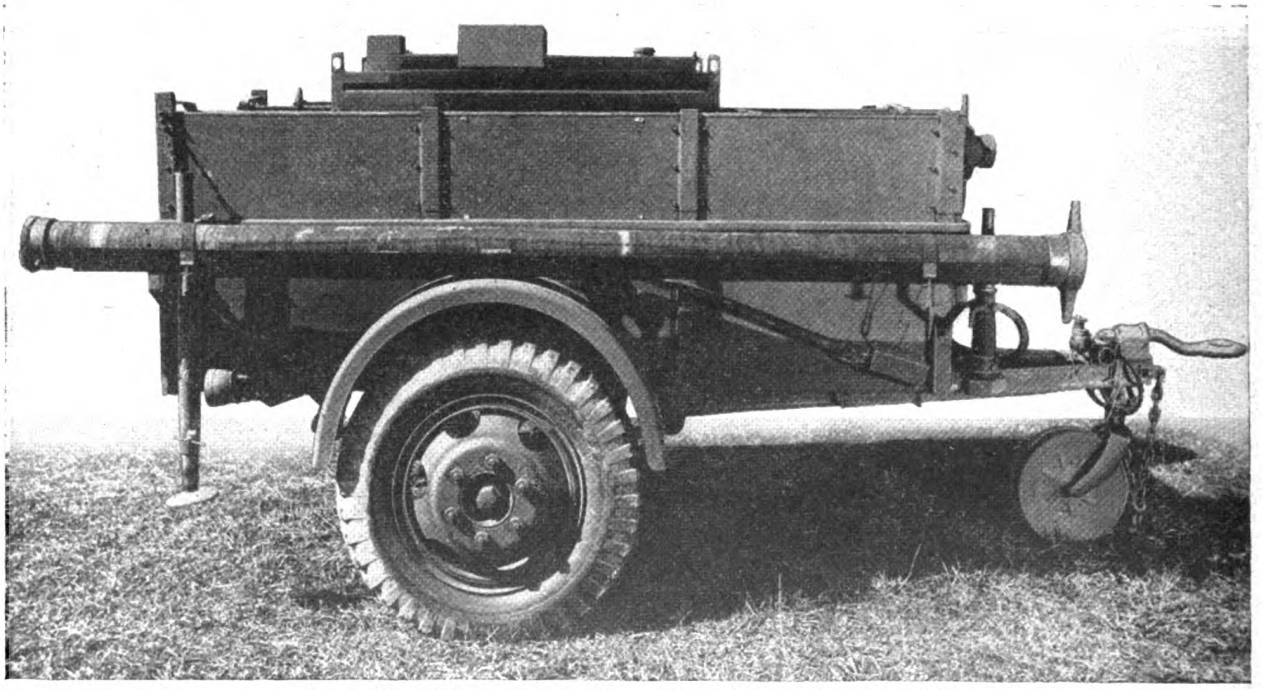

Figure 9. Class 1000 fire trailer. (Stock No. 58–9050.700–910.)

a. TRAILER. The trailer weighs 4,500 pounds fully loaded. It has a 2,500-pound pay-load capacity.

b. PUMP. (1) The pump is a centrifugal type skid-mounted unit directly connected to a 90- to 110-hp engine. The engine cooling system is designed to permit operation for long periods without overheating.

(2) The pump does not have a permanently installed relief valve or pressure regulator. The pump operator meets changing fire-fighting requirements by adjusting manually-operated controls.

(3) It can supply two 2½-inch hose lines within the following limits:

(*a*) 500 gpm at 120 pounds net pump pressure.

(*b*) 250 gpm at 200 pounds net pump pressure.

(*c*) 167 gpm at 250 pounds net pump pressure.

c. HOSE. The trailer body has space for 300 feet of 1½-inch and 500 to 700 feet of 2½-inch hose.

10. Skid-mounted Apparatus

The class 1100 skid-mounted water-pumping unit (fig. 10) is the only skid type unit issued by the Corps of Engineers. It can be used for stationary pumping or it can be mounted on a vehicle to make an expedient self-propelled unit. A self-contained pumping unit, consisting of power plant and 500-gpm pump, is mounted on a single skid base. The pump has the same characteristics as the pump on the class 1000 trailer.

Section III. ROUTINE INSPECTIONS AND PREVENTIVE MAINTENANCE SERVICES

11. General

Because fire apparatus is for emergency use only, careful attention to proper maintenance is essential to insure that equipment will be in condition to operate when emergencies arise. This section outlines the maintenance required to prevent breakdowns and dead-lined equipment. Procedures given are general in nature and apply to all types of fire apparatus operating under various weather and field conditions. Individual modifications may be necessary at some posts to meet special operating conditions.

12. Maintenance Responsibility

The fire chief is responsible for insuring complete serviceability of all motor-driven fire apparatus. However, he may delegate supervision of the work to subordinate fire department officers. The apparatus driver performs the first-echelon services prescribed in this manual. Maintenance involving specialized equipment or knowledge is performed by the post

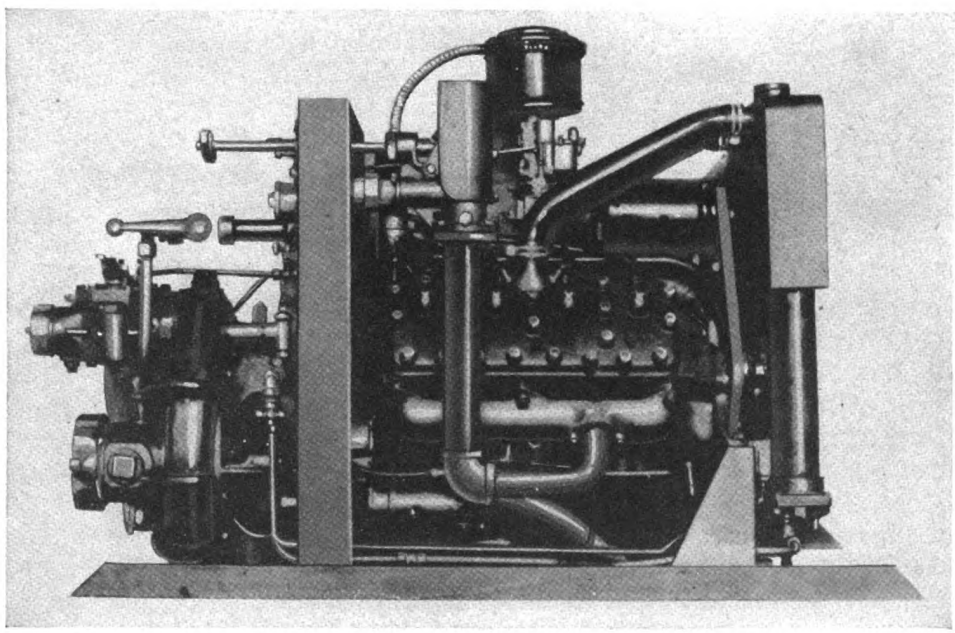

Figure 10. Class 1100 skid-mounted pumping unit. (Stock No. 11-9100.500-000.)

motor pool shop in accordance with the following basic requirements:

a. Motor apparatus is dispatched to motor pool shop by responsible fire department officer.

b. Responsible fire department officer contacts motor pool shop beforehand and arranges highest maintenance priority for fire apparatus to insure that it is not out of service overnight.

c. Generally, the apparatus driver accompanies apparatus to motor pool shop and gives any necessary assistance.

d. Major repairs to fire apparatus are made in coordination with service command fire equipment inspectors.

13. Lubrication

Because of the way fire apparatus is used, lubrication schedules cannot be based on the normal index, mileage. Although the average Army fire truck travels 1,000 miles in about 3 years, the pump and engine actually get the equivalent of 1,000 speedometer miles of wear in a few pumping operations. Therefore, lubrication schedules are based on hours of use for pump and engine, and calendar days of use for the chassis. Careful records of use must be kept to insure correct lubrication. Prescribed lubrication schedules are outlined in applicable War Department Lubrication Orders. Special lubrication required in subzero temperatures is covered in periodically issued lubrication bulletins and directives.

14. Daily Inspections and Services

The fire-fighter driver performs the inspections and preventive maintenance services below daily when he starts his tour of duty.

a. FUEL LEVEL. Check fuel-gauge reading. If gauge shows tank is less than three-quarters full, refill tank.

b. ENGINE-OIL LEVEL: Check oil level with dip stick. Add oil if level is below three-quarter mark.

c. RADIATOR. Check water level in radiator and refill if water is more than one finger length below radiator top. If cooling system is protected with antifreeze, test concentration with a hydrometer and add antifreeze if necessary. Inspect all hose connections and replace those which are defective.

d. TIRES. Test tires with air-pressure gauge. If pressure is below that prescribed in current tire-pressure schedules, inflate to correct pressure. Inspect tires for unusual wear. Remove nails, glass, or other foreign objects that may have been picked up in road travel, taking care not to damage tire and tube further. Remove objects lodged between duals. Replace missing valve caps.

e. LIGHTS. Test operation of all driving, parking, and stop lights, and replace any that are defective. Inspect light wiring for loose connections and chafing. Test dimmer switch and have it replaced if defective.

f. BATTERY. Measure specific gravity of each battery cell with a hydrometer. If specific gravity is below 1.225, recharge or replace battery. In subzero temperatures, do not let specific gravity fall below 1.250. If subzero temperatures are anticipated, set generator for a higher charging rate.

g. ENGINE. (1) Examine exterior of engine and accessories for signs of gasoline, oil, or water leaks. Trace all signs of leaks to their source and have necessary repairs made.

(2) Examine starter and generator mounting belts and tighten if loose.

(3) Check lubrication points. Oil or grease as required in accordance with War Department Lubrication Order, vehicle manual, current lubrication bulletin, or directives.

(4) Check fan-belt alignment and tension and look for unusual wear. Adjust if necessary, following instructions in vehicle manual.

(5) Check ignition system for loose connections, chafing of wires, or other possible source of injury. Tighten or replace wiring as required.

h. CHASSIS. (1) Examine under side of chassis for signs of oil, water, gear-oil, gasoline, or brake-fluid leaks. If there is any sign of leakage, trace to source and have corrections made.

(2) Check foot brake and clutch pedal for free travel. If there is less than 1 inch of travel, have correct adjustment made in accordance with vehicle manual.

(3) Check lubrication points. Oil or grease in accordance with War Department Lubrication Order, vehicle manual, current lubrication bulletin, or directives.

i. BODY. Examine handrails, rear platforms, and running-board brackets for security. Tighten loose brackets and replace those which are weak or defective.

j. FIRE PUMPS AND ACCESSORIES. (1) Make sure all drain valves on fire pump and accessories are closed; if they are open, pump cannot draft water.

(2) Check discharge gates for freedom of movement. If gates operate with difficulty, lubricate with graphite by dusting cylinder of gate and opening and closing valve several times until gates operate freely.

(3) Check operation of suction-inlet and discharge-outlet caps and look for sticking gaskets. Where required, clean threads and install new gaskets.

(4) Examine suction hose for obstructions. If any are found, remove them and notify the officer in charge.

(5) See that relief valve is at normal required setting.

k. BOOSTER TANK. (1) Check water level in booster tank. If level is low, see that filter screen is in place and secure, then fill tank through deck opening.

(2) Test ease of operation of tank suction, drain, and discharge valves. Adjust or lubricate improperly operating valves.

l. EQUIPMENT. Check that all minor equipment assigned to apparatus is present, properly placed, and secure.

15. Inspections and Services After Each Run

After each drill or fire alarm, the fire-fighter driver inspects his apparatus as soon as he returns it to the fire station. In addition, he notifies the senior officer of any unusual performance en route to, at, and returning from the fire or drill. Inspections and services after each run, outlined below, are similar to daily inspections and services; the repetition is necessary because of the heavy demands on apparatus during emergency operations.

a. CHASSIS. (1) Inspect under side of chassis for any sign of damage to running gear caused by road travel. Report any damage immediately to senior officer in charge.

(2) Check brakes for signs of overheating. If brakes overheat, take corrective action immediately.

(3) Inspect tire for nails, cuts, glass, or other foreign objects. (See par. 14*d*.)

(4) Test operation of all apparatus lights Replace defective bulbs or sealed-beam lights.

(5) Check fuel level. (See par. 14*a*.)

b. ENGINE. (1) Check oil level and condition of oil. If necessary, add or change oil. (For correct grade, see War Department Lubrication Order.)

(2) Look for water, oil, gasoline, or other leaks. (See par. 14*h*(1).)

(3) Check for loose electrical connections and starter and generator belts. Tighten if required.

(4) Inspect fan belt. (See par. 14*g*(4).)

(5) Oil or grease all lubrication points as required. For specific instructions, see War Department Lubrication Order, vehicle manual, current lubrication bulletin, or directives.

(6) Check water level in radiator and add water if necessary. (See par. 14*c*.)

c. BOOSTER TANK. For booster-tank service, see paragraph 14*k*.

d. FIRE PUMP AND ACCESSORIES. (1) If salt or dirty water has been used, flush pump out thoroughly with fresh water.

(2) Inspect suction-inlet and discharge-outlet valves for sand or other abrasives. If abrasives are found, clean valves immediately.

(3) Inspect suction hose for missing or damaged gaskets and loose lining. Replace defective gaskets or hose.

(4) Check connections on gauges and cooling and vaccum lines. Tighten if loose.

(5) Check drain valves. (See par. 14*i*(1).)

(6) Check oil level in primer-pump oil reservoir. See that air vent is open. Add oil if required; see War Department Lubrication Order or vehicle manual for correct grade of oil.

(7) Note pressure setting of relief valve, pressure regulator, or pressure governor. If necessary, reset within range of operating safety or rated capacity of pump at lowest pressure.

(8) Oil the primer pump, following instructions in War Department Lubrication Order or vehicle manual.

(9) Check leakage around packing glands. Slight leakage is desirable as this lubricates packing and prevents burning. If leakage is excessive, tighten adjusting nuts.

(10) Lubricate pump and drive-unit bearings in accordance with War Department Lubrication Order or vehicle manual.

(11) Remove suction cap and strainer on two-stage pump and inspect suction check valve for freedom of operation. Make sure no foreign matter is caught between valve and seat.

(12) If apparatus has a front-mounted pump, service self-closing valve in discharge head as follows:

(*a*) Remove discharge cap.

(*b*) Reach through opening with a screw driver and lift the self-closing rubber-faced valve from seat.

(*c*) Inspect valve and valve seat and remove any foreign matter from valve chamber.

e. EQUIPMENT. See that all minor equipment assigned to apparatus is present, properly placed, in good working condition, and secure.

16. Weekly Inspections and Services

Weekly preventive maintenance operations supplement the daily checks by servicing parts that would otherwise operate improperly because of accumulations of sediment and dirt, corrosion, etc. Qualified fire department personnel perform these inspections and services.

a. BATTERY. Clean battery case, compartment, terminals, and cable ends. If they are corroded, wash with a weak solution of bicarbonate of soda and flush with clean fresh water. Scrape terminal post and cable ends or clean them with a wire brush, apply thin coat of lubricant, replace, and tighten. Add just enough water to each cell to cover plates; do not let water get more than ¼ inch above plates. See that battery is clamped securely in place.

b. BOOSTER TANK. Clean tank thoroughly of all loose scale and iron rust by opening tank drain valve and flushing tank with water from a small hose line under pressure. Continue flushing until water runs clear, then drain tank. Close drain valve and refill tank with clean water.

c. FIRE PUMP. Test suction of centrifugal pumps as follows:

(1) Close all valves and discharge gates tightly and make sure suction caps are tight.

(2) Start engine. Shift pump gear lever to *pump* position and pull throttle out until engine idles a little faster than normally. Operate primer until vacuum gauge shows a reading of about 20 inches. This should not require more than 30 seconds.

(3) Stop engine and listen for leaks. If there are none, pump should hold vacuum for 1 to 2 minutes. Locate and correct all leaks. A very slight leak at the pump bearing does no harm, but excessive leaks must be repaired.

(4) Leaks which cannot be located in this way can be found by connecting pump to a hydrant and subjecting pump to hydrant pressure.

17. Monthly Inspections and Services

Monthly inspection and services require special skills and tools not normally found in a post fire department. Therefore, the post motor pool or other shop performs them, depending on local regulations governing responsibility for this echelon of service. The inspection consists of items listed below. For procedure, see TM 37–2810. Use the manufacturer's maintenance manual for supplementary technical information and WD AGO Form 461 as a check list. (Inspection reference numbers alongside services below refer to that form.)

Inspection reference	*Maintenance service*
a. ROAD TEST.	
1	Before-operation inspection.
2	Air pressure (build-up) (governor-cut-off) (low-pressure indicator).
3	Dash instruments and gauges (oil pressure) (ammeter) (speedometer) (tachometer) (temperature) (fuel).
4	Horns, mirrors, and windshield wipers.
5	Brakes; foot, hand (braking effect) (feel) (side pull) (noise) (chatter) (pedal travel).
6	Clutch (free travel) (drag) (noise) (chatter) (grab) (slip).
7	Transmission and transfer (lever action) (declutching) (vibration) (noise).
8	Steering (free play) (bind) (wander) (shimmy) (side pull) (column and wheel).
9	Engine (idle) (acceleration) (power) (noise) (governed speed).
10	Unusual noises (attachments) (cab) (body) (wheels).
11	Brake booster operation.
13	Temperatures (brake drums) (hubs) (axles) (transmission) (transfer).
14	Leaks (engine oil) (water) (fuel).
16	Gear-oil level and leaks (axles) (transmission) (transfer).
b. ENGINE AND ACCESSORIES.	
18	Cylinder head and gasket.
19	Valve mechanism (clearances) (lubrication) (cover gaskets).
20	Spark plugs (gaps) (deposits).
21	Compression test (record).

Inspection reference	*Maintenance service*
22	Battery (cables) (hold-downs) (carrier) (record gravity and voltage).
23	Crankcase (leaks) (oil level).
24	Oil filters, coolers, and lines.
25	Radiator (core) (shell) (shutters) (mountings) (hose) (cap and gasket) (antifreeze, record) (overflow tank) (steam-relief tube and valve).
26	Water pump, fan, and shroud.
27	Generator, starter, and switch.
29	Drive belts and pulleys.
30	Tachometer drive and adapter.
31	Distributor (cap) (rotor) (points) (shaft) (advance units).
32	Coil and wiring (high and low voltage) (supports).
33	Manifolds and heat control (gaskets) (seasonal setting).
34	Air cleaners (carburetor).
35	Breather caps and ventilators.
36	Carburetor (choke) (throttle) (linkage) (governor).
37	Fuel filters, screen, and lines.
38	Fuel pump (vacuum and pressure).
39	Starter (action) (noise) (speed).
40	Leaks (engine oil) (fuel) (water).
41	Ignition timing (advance).
42	Engine idle and vacuum test.
43	Regulator unit (connections) (voltage) (current) (cut-out).

c. CHASSIS, BODY, AND ATTACHMENTS.

47	Tires and rims (valve stems and caps) (condition) (direction) (matching).
48	Rear brakes (drums) (supports) (cylinders) (cams and shafts) (magnets and armatures).
49	Rear brake shoes (linings) (links) (guides) (anchors).
51	Rear spring seats and bearings.
52	Rear wheels (bearings) (seals) (drive flanges) (nuts).
53	Front brakes (drums) (supports) (cylinders) (cams and shafts) (hose) (push rods and seals) (adjusters).
54	Front brake shoes (linings) (links) (guides) (anchors).
55	Steering knuckles (joints) (bearings) (seals) (boots).
56	Front springs (clips) (leaves) (U-bolts) (hangers) (shackles).
57	Steering (arms) (tie rods) (drag link) (seals and boots) (Pitman arm) (gear) (column) (wheel).
58	Front shock absorbers and links.
60	Front wheels (bearings) (seals) (flange) (axle and play) (nuts).
61	Front axle (pinion and play) (seal) (vent) (alignment).
62	Front propeller shaft (joints and alignment) (seals) (flanges).
63	Engine (mountings and braces) (ground strap) (side pans).
64	Hand brake (ratchet and pawl) (linkage) (drum or disk) (lining).
65	Clutch pedal (free travel) (linkage) (return spring).
66	Brake pedal (free travel) (linkage) (return spring).
67	Brake master cylinder (vent) (fluid level) (leaks) (switch).
68	Brake vacuum booster (linkage) (air cleaner and hose) (cylinder).
71	Transmission (mounting) (seals) (power take-off) (linkage).
72	Transfer (mountings) (linkage) (seals) (vent) (power take-off).
73	Rear propeller shafts (see 62).
75	Rear axles (pinion end play) (seals) (vents) (alignment).
77	Rear springs (clips) (leaves) (U-bolts) (hangers) (shackles).
78	Rear shock absorbers and links.
79	Cab and body mountings.
80	Frame (rails and cross members).
81	Wiring, conduits, and grommets.
82	Fuel tanks, fittings, and lines.
83	Brake lines (fittings) (hose).
84	Exhaust pipes and muffler.
85	Vehicle lubrication.
86	Toe-in and turning stops.
91	Lamps (head, tail, body, running, directional, stop, and blackout).
93	Front (bumpers) (tow hooks) (grills).
94	Hood (hinges) (fasteners).

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Inspection reference	*Maintenance service*
95	Front fenders and running boards.
96	Cab (doors) (hardware) (glass) (top and frame) (curtains and fasteners) (seats) (safety straps and grab rails) (floor boards and mats) (ventilators).
97	Heater, fan, and defroster.
98	Circuit breaker and fuse block.
99	Rear fenders and splash guards.
101	Rear bumper and pintle hook (latch and lock pin) (drawbar).
103	Paint and markings.
104	Radio bonding (suppressors) (filters) (condensers) (shielding).

d. TOOLS AND EQUIPMENT.

131	Tools (vehicle).
135	Publications (War Department and manufacturer's manuals).
136	Traction devices (chains).
142	Final road test.

(Add following at bottom of WD AGO Form 461.)

e. FIRE PUMP AND ACCESSORIES.

143	Pump-drive transmission case (quantity and condition of lubricant) (add lubricant if necessary, or drain and refill).
144	Bolts and mountings (tighten).

18. Semiannual Inspections and Services

Check parts which require only infrequent attention during the semiannual inspections and services. Personnel responsible for monthly servicing also perform the semiannual check-up. For inspecting procedure, see the War Department Lubrication Order for the apparatus.

Section IV. OPERATIONAL PREVENTIVE MAINTENANCE

19. General

Correct driving and operating practice play an important part in the preventive maintenance program. Careless driving and poor operating methods can nullify the value of the entire program by damaging and needlessly dead-lining apparatus. Some of the more common harmful driving and operating practices are listed below.

a. PRACTICES HARMFUL TO CHASSIS AND ENGINE.

(1) Racing a cold engine.

(2) Excessive use of choke.

(3) Engaging clutch too quickly.

(4) Slipping clutch.

(5) Starting apparatus in other than first gear.

(6) Riding with foot on clutch pedal.

(7) Jamming gears when shifting. Changing from one gear to another without regard to engine or road speed.

(8) Stopping apparatus too quickly.

(9) Driving faster than road conditions warrant.

(10) Bumping curb.

(11) Turning corners too fast.

(12) Failing to watch for or report any unusual operation or operating noises.

b. PRACTICES HARMFUL TO FIRE PUMP AND TRANSMISSION. (1) Excessive engine speed while attempting to engage pump clutch.

(2) Jamming gear in forcibly.

(3) Jerking hand throttle open or shut.

(4) Jerking discharge valves open or shut. When hose lines are shut off quickly, the sudden shock transmitted may burst hose or water main, damage pumping equipment, or injure the fire fighter.

(5) Opening churn valve before decreasing engine speed.

(6) Racing engine to secure desired pressure or while priming pump.

(7) Pumping with engine too cool.

(8) Failing to lock gear shift while pumping.

(9) Failing to set relief valve at proper operating pressure.

(10) Operating pump in improper gear.

(11) Failure to maintain necessary depth over suction inlet when pumping from draft.

(12) Operating pump at overload capacity.

20. Engine Warm-up

Warming up the engine of fire apparatus each time the shift changes is unnecessary since it gives no assurance that the vehicle will start the next time it is needed. It can be extremely harmful, because most engine wear takes place during the first few seconds of motor operation before normal oil flow starts and an oil film is established. In addition,

when a cold engine is started, run for only a few minutes, and allowed to cool, moisture and gasoline condense on working parts of engine and crankcase. The moisture corrodes interior engine parts and emulsifies with the oil, forming a sludge in the crankcase which may cause failure of the lubrication system. Therefore, fire apparatus is started only to respond to an emergency or drill or in the performance of routine maintenance. Whenever an engine is started for drill or routine maintenance, it must be run until the temperature indicator registers 160° to 180°. This permits the engine to warm up enough to vaporize condensed moisture in the crankcase. Covering the radiator speeds the warm-up process.

21. Operating in Subzero Weather

For methods of protecting fire apparatus in subzero weather, see section V of this chapter.

Section V. WINTERIZATION

22. General

Because of the variety of chassis and pumps in service at Army posts, winterization of fire apparatus is an individual problem. Depending on apparatus to be protected and conditions of use, one or more of the methods discussed below may be required.

a. GENERAL PRECAUTIONS. (1) Whenever possible, quarter mobile fire-fighting equipment in heated buildings. If that is not possible, provide improvised sheds or shelters and equip them with enough heaters to maintain a temperature of at least 50° F. If vehicles are parked outside in subzero weather, they need from 1 to 5 hours to warm up, depending on weather conditions, unless they are equipped with a heater which is operated continuously. If heated buildings or shelters are not provided, it is extremely difficult to drain and dry hose and other accessories and to keep extinguishers and foam liquids from freezing.

(2) Gauges may freeze after apparatus leaves the fire station. Therefore, pump operators must be able to use expedient methods of approximating pump pressures.

(*a*) By learning how the engine sounds at different pumping pressures, the operator can approximate required pressures by ear.

(*b*) On some apparatus, the speedometer registers when the pump is operating. By learning speedometer readings for different pumping pressures, the operator can pump at required pressures when the gauge is not working.

(3) If hose nozzles are closed in extreme cold weather, hose and nozzles freeze rapidly. Therefore, if enough water is available after pumping is completed, leave nozzles open and keep a slow stream of water flowing through the hose while it is being uncoupled. Roll or fold hose immediately after uncoupling it.

(4) For a guide to cold-weather lubrication and servicing of trucks, see current Ordnance Department manuals.

(5) For measures to protect fire extinguishers against freezing, see chapter 3.

b. WINTERIZATION METHODS. Basic winterization methods are discussed in paragraphs 23 through 26. The methods are:

(1) Dry system.

(2) Antifreeze-solution system.

(3) Insulating pump and lines.

(4) Heating by truck exhaust or unit heaters.

23. Dry System

The dry system of winterization consists of removing all water from pump, valves, hose, and piping, and getting them dry enough to keep from freezing after apparatus leaves the fire house.

a. VEHICLE MODIFICATIONS. The following vehicle modifications may be necessary:

(1) Change location of tank valve between inlet and pump suction so it is as near the tank as possible.

(2) Protect tank valve and piping between valve and tank by one of the following methods:

(*a*) Wrap valve and pipe with insulating material. Do not cover valve handwheel.

(*b*) Inclose valve and piping in a metal compartment heated by the engine exhaust.

(3) Protect pressure gauges by *all* of the following:

(a) Install an extra glass face on gauge, separating it from gauge face by a rubber or felt ring.

(*b*) Cover entire gauge except glass face with insulating material.

(*c*) Insulate line between gauge and pump. There is no flow of water through this line and it freezes quickly if left unprotected.

b. DRYING PROCEDURE. To free the system of water, proceed as follows:

(1) Drain pump and all piping thoroughly. If possible, remove water from pipes and hose reels by connecting an air line to pump and draining each line separately, using air to force water out.

(2) Even with compressed air, it is difficult to remove all moisture from parts such as impellers, seal rings, and gauges. To keep such parts from freezing, fill pump and piping system with an antifreeze solution. (See par. 24.) Turn pump over a few times so solution reaches all parts, then drain pump. Moisture remaining in pump is diluted with antifreeze and will not freeze. Antifreeze solution which has been drained from pump can be reused.

(3) On reaching a fire, lay hose lines, place pump in operation, and open hose nozzles before turning on water from tank.

24. Antifreeze-solution System

The antifreeze-solution method of protection consists of filling the pump, piping, and hose lines with antifreeze between hose discharge and tank valves. Treatment of booster tank by this method is not recommended. This prevents freezing when apparatus is outside the fire station. In addition, since the pump is filled, it eliminates the need for priming. However, the antifreeze is lost each time the pump is used and must be replaced when apparatus returns to the fire station.

a. PREPARING SOLUTION. Ethylene glycol (Prestone) is the antifreeze compound most commonly used at Army posts. Depending on its concentration, it can be used to protect apparatus at temperatures as low as —50° F. The proportions below are based on Prestone; if another antifreeze compound is used, this schedule must be modified to suit the characteristics of the particular compound.

Lowest expected temperature (°F.)	*Pints of Prestone per gallon of solution*
—10	3
—20	3½
—30	4
—40	4½
—50	5

Note. For additional information on these solutions, see TM 9-2858.

b. PROTECTING APPARATUS. To protect apparatus and equipment with antifreeze, proceed as follows:

(1) *Drain pump, piping, and booster hose completely.* If water is left in the apparatus, strength of the antifreeze solution will be reduced.

(2) If apparatus has a centrifugal pump, draw antifreeze solution into pump by means of the primer. Discharge solution through pump into lines, piping, and valves. Continue until all parts are filled with solution.

(3) If apparatus has a piston or rotary pump, draw antifreeze solution into pump by operating pump until pump, piping, valves, and lines are filled with solution. Solution can also be introduced into pump through a short length of ¾- or 1-inch booster hose connected to pump suction line.

(4) To keep gauges from freezing during operation after antifreeze has been pumped out, protect them as in paragraph 23*a*(3).

25. Insulating Pump and Lines

Apparatus can also be protected by covering the pump and lines with insulation. The pump and lines take up heat while in a heated building; the insulation retains some of that heat until the truck reaches the fire and pumping begins.

a. Wrap all pipes, gauges, and small copper-tube lines from pump to primer, pressure regulator, and radiator.

(1) Use regular pipe-insulating material if possible. Pack joints in insulation with plastic asbestos. Coat insulation with water-repellent paint.

(2) If regular insulating material is not available, improvise insulation by wrapping strips of woolen blankets around parts to be protected. Cover wool strips with strips of canvas and fasten with clamps to hold the material in place. Coat the canvas with varnish, water glass (sodium silicate), asphaltum paint, or similar waterproofing compound.

b. To insulate front-mounted pumps, prepare a blanket-lined canvas cover which attaches to the radiator and completely covers the pump. Fix snap fasteners at sides and center of cover so it can be opened to attach suction and discharge hose and to operate valves. The cover has little protective value when the pump is operating at a fire. However, as long as the pump operates and water is flowing, there is little danger of the pump freezing.

26. Heating by Truck Exhaust or Unit Heaters

Heat from the engine exhaust can be utilized to keep apparatus from freezing. Unit heaters can also be installed to protect individual parts.

a. PUMP. Inclose midship-mounted pumps in compartments made of insulated metal panels. Connect pipes from exhaust to compartment to conduct exhaust gases and keep pump warm. To prevent leakage, fit canvas boots around shift control levers.

b. GAUGES. Build similar compartment around gauges, but put a glass front on one side so gauge dials can be read.

c. TANK. Attach a metal compartment under water tank. Pipe exhaust gases through compartment to heat the tank. The tank can also be protected by installing in it a self-contained hot-water heater which has an expansion tank in the system.

Section VI. RECORDS

27. Maintenance Records

Complete records of inspections and services are necessary to insure satisfactory performance of the maintenance program. Properly kept maintenance records help determine the cause of apparatus failure and assist in fixing responsibility. They also reveal the possible need for local modifications in maintenance schedules and operations.

a. SCOPE OF RECORDS. The senior fire department officer at each fire station is responsible for keeping a record of maintenance performed on each piece of apparatus in the station. Records must be complete, covering all inspections and services discussed in section III of this chapter, or required by regulations, bulletins, and directives. Any convenient form and record-keeping system can be used.

b. FILING RECORDS. Maintenance records are kept at the same fire station as the apparatus to which they apply. They must be kept up to date and available for inspection by higher echelon at any time.

CHAPTER 3

FIRE EXTINGUISHERS

Section I. GENERAL

28. Scope

This chapter describes the hand extinguishers and hand-drawn chemical engines used at military installations and gives procedures for inspecting and maintaining them. Proper methods of recharging, tagging, and nonfreeze protection are also included.

29. Inspection and Maintenance

Although their capacity is limited, first-aid extinguishers are most effective in putting out small fires quickly before they get out of control. Therefore, fire extinguishers must be inspected and maintained regularly to insure quick, proper operation in emergencies; they must be conspicuously located, readily accessible, and properly distributed in relation to fire hazards. Mount extinguishers so there is no danger of accidental injury by personnel, supplies, or traffic movement. Hang hand type extinguishers on hangers or set them on brackets or shelves so the extinguisher top is not more than 5 feet above the floor. Mark extinguisher location conspicuously by painting or placards.

a. RESPONSIBILITY. The post fire marshal is responsible for providing and maintaining fire extinguishers and hand-drawn engines at all locations in accordance with current tables of distribution. Responsibility for maintaining this equipment is assigned to the fire chief. If local regulations place responsibility for periodic inspections with personnel not in the fire department, the results of each such inspection, even though no maintenance is required, must be reported directly to the fire chief.

b. FREQUENCY. Designated qualified personnel responsible to the fire marshal make detailed monthly, semiannual, and annual inspections of all hand fire extinguishers and chemical engines. In addition, responsible occupants of buildings check extinguishers usually each day to make sure they are available for use.

(1) *Monthly inspections.* Monthly inspections are largely visual; extinguishers are not taken from the brackets or handled unless signs of failure are evident. If inspectors are not fire department personnel, they submit written reports listing satisfactory conditions and deficiencies in separate paragraphs. Qualified fire department personnel take necessary corrective action. Inspectors record their inspections on the extinguisher tag. (See par. 32.)

(2) *Semiannual inspections.* Semiannual inspections are more thorough inspections by trained personnel. They also enter their findings on the extinguisher tag.

(3) *Annual inspections.* Annual inspections include a complete check and operation test of each unit. Certain types are recharged each year. Proper notations are made on tags and in records at fire department headquarters.

c. REPAIRS AND REPLACEMENTS. Only qualified fire department personnel make repairs or replacements, in accordance with the following:

(1) Do not repair containers on types where source of pressure is internally stored or chemically generated. Repairs are limited to replacement of accessible gaskets, hose assemblies, or accessible interior parts.

(2) Hydrostatic tests require special equipment not ordinarily available at posts. When the 5-year test required by AR 850–60 or Interstate Commerce Commission (involving interstate shipment) for high-pressure cylinders is due, send carbon dioxide cylinders to military or commercial installations with facilities for making the test.

(3) Repairs are preferably made by replacement of assemblies. For example install a complete pump rather than a pump barrel.

d. INSTRUCTION CARDS. The following fire-extinguisher instruction cards are available through Adjutant General Depots as maintenance guides:

104–E–22–A Water Pump-tank Hand Fire Extinguisher.

104–E–22–B	Foam Pump-tank Hand Fire Extinguisher.
104–E–22–C	Foam Hand Fire Extinguisher.
104–E–22–D	Carbon Tetrachloride Hand Fire Extinguisher, 1-quart Type.
104–E–22–E	Carbon Tetrachloride Hand Fire Extinguisher, 1-gallon Type.
104–E–22–F	Soda-acid Hand Fire Extinguisher.
104–E–22–G	Carbon Dioxide Hand Fire Extinguisher.

30. Safety Precautions

a. VENTILATING. Immediately after using extinguishers in small unventilated spaces, such as closets or totally inclosed airborne or mobile equipment, all personnel must thoroughly ventilate the area to avoid breathing the vapor or gases liberated or produced. This applies especially to carbon dioxide and carbon tetrachloride extinguishers.

b. CHARGING. Charging or maintaining extinguishers incorrectly, particularly generated-pressure types, can result in fire losses or personnel injury. Mechanical obstructions or incorrect proportions of chemical ingredients can cause excessive pressure inside the extinguisher which may rupture the extinguisher shell.

Section II. TAGS

31. General

A record tag must be attached to each extinguisher at all times. *If the tag is missing, the extinguisher must be removed, fully inspected, and retagged.* Tags are stocked in Adjutant General Depots and Air

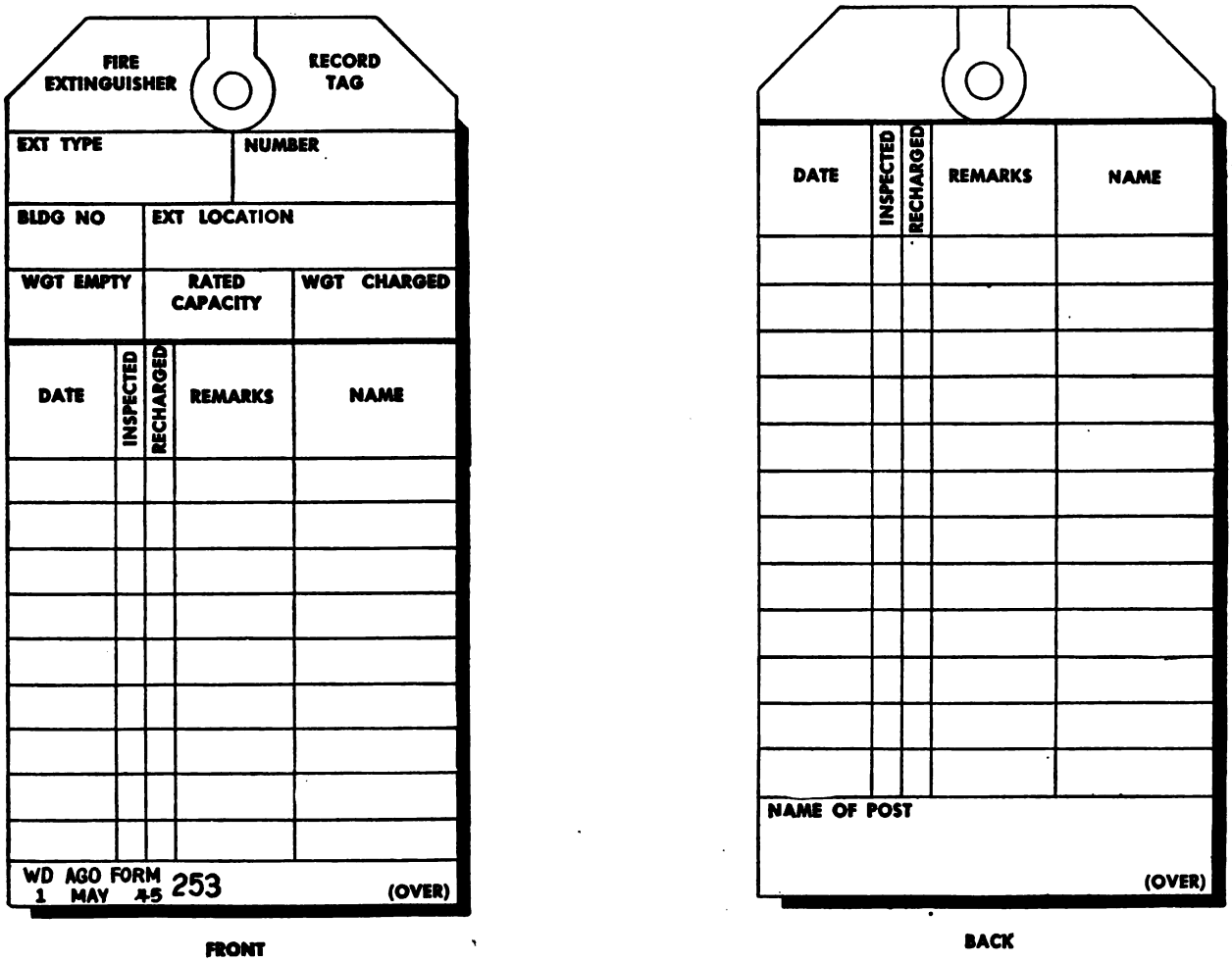

Figure 11. Tag for carbon dioxide extinguisher. (Color must be green.)

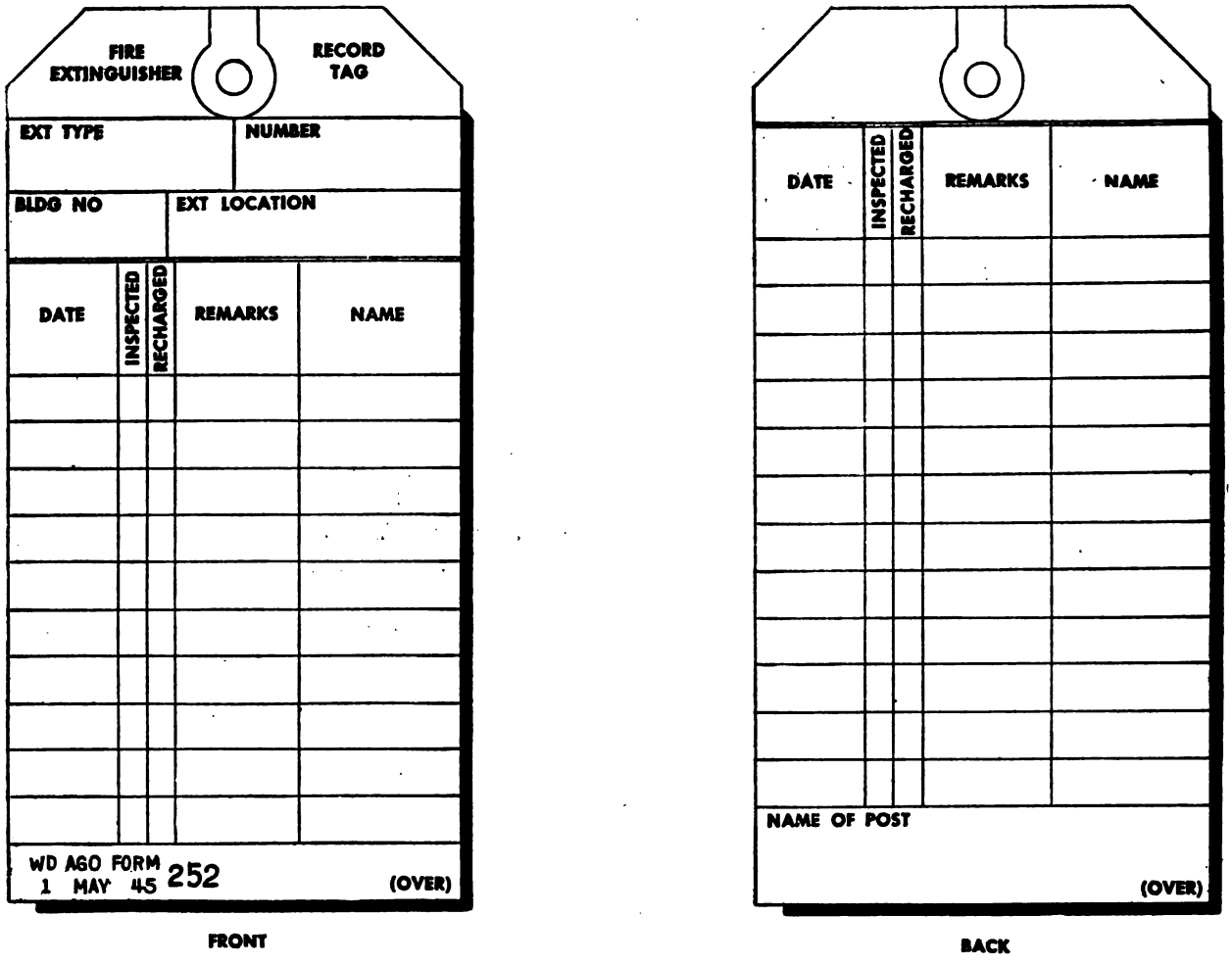

Figure 12. Tag for all other types. (Green may not be used.)

Technical Service Command Depots, available for issue on requisition.

32. Form

Record tags are printed in two forms: WD AGO Form 253 (fig. 11) for carbon dioxide gas types and WD AGO Form 252 (fig. 12) for all other types. The following information is recorded:

a. EXTINGUISHER TYPE. State type and capacity.

b. NUMBER. Use cylinder number stamped near top of cylinder (carbon dioxide type), Underwriters' Laboratories label number, or local number if station numbering system is maintained.

c. BUILDING NUMBER. If in or on a building, give building number.

d. EXTINGUISHER LOCATION. Give point of location of extinguisher.

e. WEIGHT EMPTY (CARBON DIOXIDE TYPE). State total weight including hose and discharge horn less all carbon dioxide.

f. WEIGHT CHARGED (CARBON DIOXIDE TYPE). State total weight including hose and discharge horn and carbon dioxide.

g. DATE INSPECTED. Enter date of inspection, giving day, month, and year.

h. DATE DISCHARGED. When extinguisher is recharged, record date.

i. REMARKS. List extinguisher defects or improper installation or surroundings in "Remarks" column.

j. INSPECTOR'S NAME. Insert name or initials of inspector.

Section III. WATER HAND-PUMP EXTINGUISHERS

33. Types

The following water hand-pump extinguishers are in common use at military installations:

a. The 2½-gallon, 4-gallon, and 5-gallon extinguishers (figs. 13, 14, and 15) which are operated from the ground by working a hand pump built into the tank.

Figure 13. Hand-pump extinguisher, 2½-gallon capacity. (Stock No. 58–4276.500–025.)

b. Two types of 5-gallon back-pack extinguishers (figs. 16 and 17) are carried on the operator's back. The model in figure 16 has a pump inside the tank which is operated by working the handle on the side of the tank. The model in figure 17 has a trombone type pump at the end of the discharge hose; it is operated by working the sleeve on the pump back and forth.

34. Charging

All water type hand-pump extinguishers are charged solely with water, except in temperatures requiring the addition of nonfreeze compounds. Size of unit indicates volume of liquid used. Directions for preparing nonfreezing solutions are given in section VIII of this chapter.

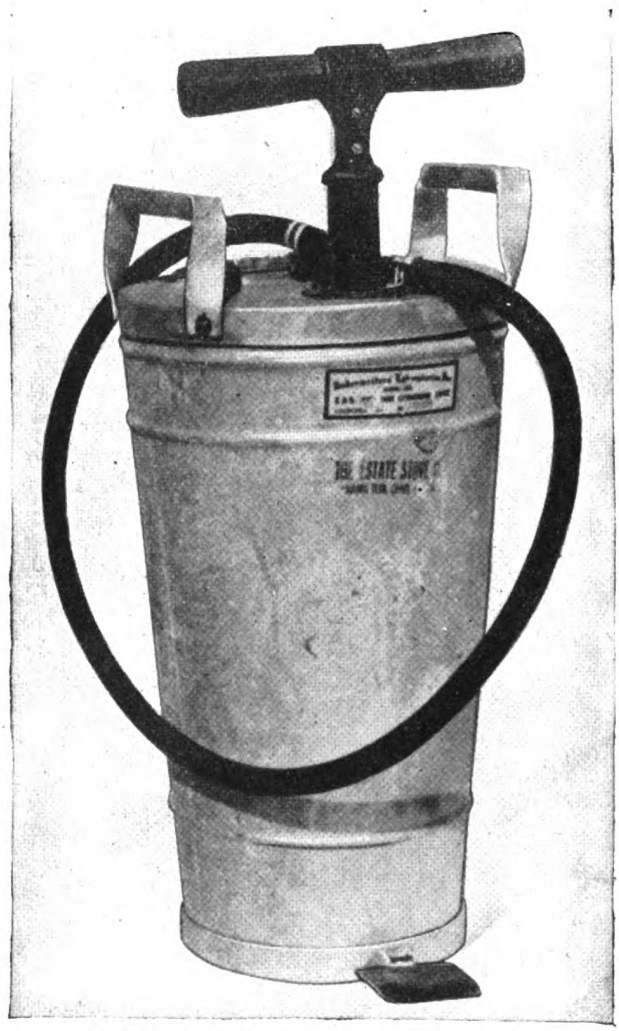

Figure 14. Hand-pump extinguisher, 4-gallon capacity. (Stock No. 58–4276.700–043.)

35. Inspection and Maintenance

a. MONTHLY. Perform the following inspections and services monthly:

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Figure 15. Hand-pump extinguisher, 5-gallon capacity. (Stock No. 58–4276.500–040.)

(1) *General.* (*a*) Examine surroundings to make sure extinguisher is readily accessible and not subject to mechanical injury. Have all obstructions removed.

(*b*) Check for new fire hazards in the protection area; change type of extinguisher or add new units if necessary.

(*c*) See that extinguishers are correctly placed to meet established criteria.

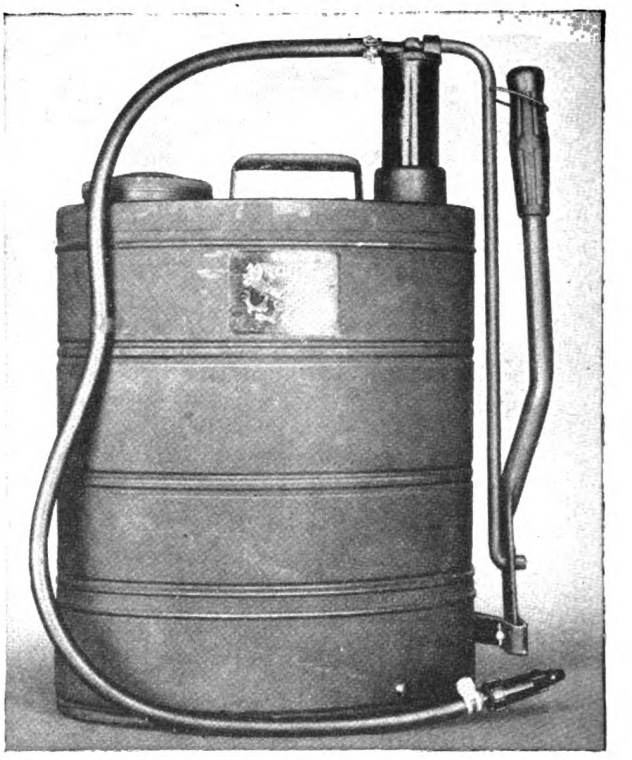

Figure 16. Back-pack type with pump handle on side of tank, 5-gallon capacity. (Stock No. 58–4276.700–055.)

(*d*) Check hanging bracket or support for security; replace, tighten, or strengthen it if necessary. See that extinguisher is easily removable.

(2) *Hose and nozzle assembly.* (*a*) Examine nozzle externally for signs of stoppage, checking visually, not with a prod. If in doubt, operate pump and observe discharge stream. Replace nozzles, if necessary, with standard replacements. Replace extinguishers which have been taken out of service for repairs or parts replacement.

(*b*) Inspect hose for possible causes of failure; look for cracks, crushed areas, or brittleness. Replace if necessary.

(*c*) Check nozzle's spray-stream adjustment. Repair or replace as necessary.

(3) *Pump.* Check pumps for operating condition. Tighten loose screws or bolts; replace missing ones. Replace extinguisher if pump shows signs of faulty operation.

(4) *Tank.* (*a*) Examine tank for mechanical injury, inspecting thoroughly those which are dented or crushed.

(*b*) Check for external corrosion or rust. Replace

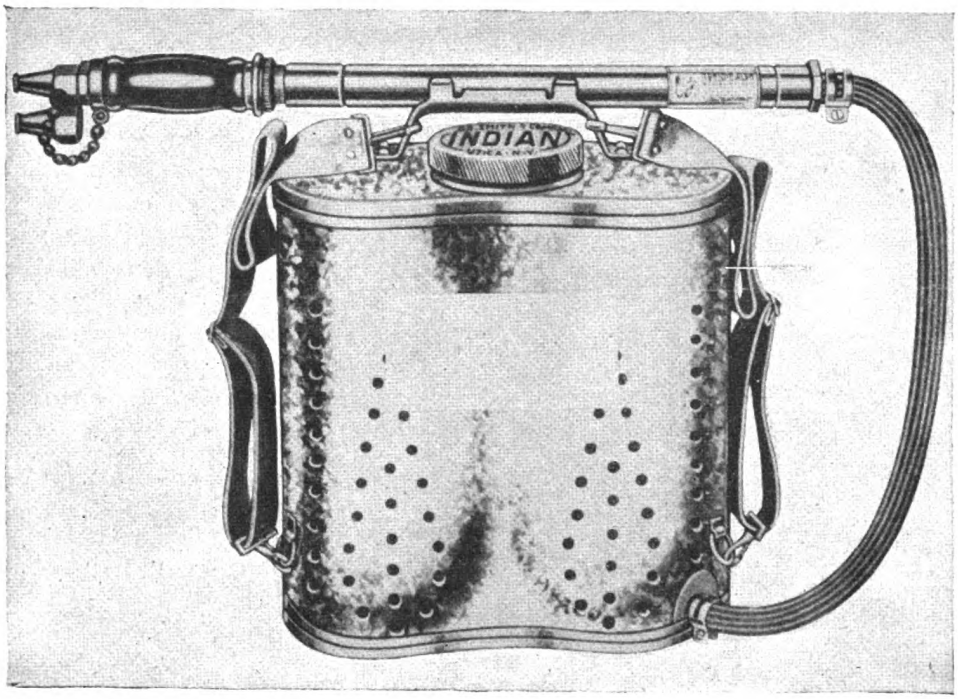

Figure 17. Back-pack type with trombone type pump, 5-gallon capacity.
(*Stock No. 58–4276.700–057.*)

extinguishers of questionable value. Because extra tanks are not available from the manufacturer, dismantle extinguishers taken out of service to get usable repair assemblies, or dispose of them through proper channels.

(*c*) Check tank cover for close fit to retard evaporation. Repair or replace as required.

(5) *Contents.* (*a*) Check contents for proper quality and quantity. Add clear water as needed. Calcium chloride does not evaporate.

(*b*) If signs of tampering with extinguisher or contents are noted, notify the fire marshal at once.

(*c*) Never leave an extinguisher with a reduced quantity of extinguishing agent.

(6) *Records.* Make required notation on extinguisher tag. If no tag is present, attach new one.

b. SEMIANNUALLY. Make the following checks semiannually:

(1) *General.* Check serial number on extinguisher to see that original installation has not been changed. Only authorized personnel may make changes.

(2) *Pump.* (*a*) Operate pump several full strokes to check operation, directing discharge back through filler opening. Be sure extinguisher remains full.

(*b*) If pump leaks, tighten packing gland without binding. Some pumps have a small antisiphon hole in the barrel that permits slight water loss during operation. Do not plug this hole.

(*c*) Put a few drops of oil on pump plunger rod.

(*d*) Pump on 4-gallon type is coated with vitreous enamel. Handle this pump carefully to prevent chipping. If enamel is broken, replace pump. Obtain new pumps directly from manufacturer.

(3) *Records.* (*a*) If serial number is lost or defaced, place proper number on extinguisher so records can be kept.

(*b*) Make entry of action taken in appropriate record book of fire department. Adequate records are vital to proper fire department administration.

c. ANNUALLY. Make the following checks annually:

(1) *Tank* (*a*) Clean tank thoroughly and flush with clear water. If calcium chloride has been used in the liquid, return liquid to tank unless it contains objectionable foreign matter.

(*b*) Inspect protective coating on interior of tank containing nonfreeze compound; if necessary repaint with two coats of asphaltum base paint.

(2) *Contents.* To winterize extinguishers, prepare calcium chloride as described in paragraph 49.

Section IV. GENERATED-PRESSURE EXTINGUISHERS

36. Types

a. 2½-GALLON SODA-ACID EXTINGUISHER. The 2½-gallon soda-acid extinguisher (fig. 18) contains 2½ gallons of water used as an extinguishing agent and chemicals used to generate pressure. The tank contains a solution of sodium bicarbonate; a glass bottle containing 4 ounces of sulfuric acid is supported in the top of the reservoir. When brought together, the two chemicals produce carbon dioxide gas which provides pressure to expel the water. A loose stopper in the mouth of the acid bottle retards absorption of moisture by the acid. When the extinguisher is inverted, the loose stopper falls partially clear of the acid bottle, allowing the contents to mix with the soda solution. The stopper's tapered stem regulates the flow of acid to prevent sudden high pressures. The rate of flow insures chemical reaction of all the acid before the solution is expelled from the extinguisher.

Figure 18. Soda-acid extinguisher, 2½-gallon capacity. (Stock No. 58–4276.600–025.)

Figure 19. Foam extinguisher, 2½-gallon capacity. (Stock No. 58–4276.400–025.)

b. 2½-GALLON FOAM EXTINGUISHER. The 2½-gallon foam extinguisher (fig. 19) is similar in size and appearance to the 2½-gallon soda-acid extinguisher but differs in internal construction and extinguishing agent. The outer chamber contains solution of sodium bicarbonate; the inner chamber, a solution of aluminum sulfate. Added to the soda solution are ingredients which assist in forming and stabilizing the foam. These materials are commonly known as stabilizers. The extinguisher is put in operation when it is inverted, permitting the contents of the two chambers to mix. The reaction produces carbon dioxide gas in bubble form. The stabilizing agent strengthens the bubble structure and produces foam which is expelled from the extinguisher by the carbon dioxide gas pressure.

c. 40-GALLON HAND-DRAWN SODA-ACID CHEMICAL ENGINE. The 40-gallon hand-drawn soda-acid chemical engine (figs. 20 and 21) operates the same as the 2½-gallon soda-acid type; however, it has greater capacity and is mounted on wheels. The narrow-tread engine has an over-all width of 30 inches to negotiate narrow passageways inside buildings; the standard-tread engine is 48 inches wide over-all and is designed for outdoor use.

d. 40-GALLON HAND-DRAWN FOAM CHEMICAL ENGINE. The 40-gallon hand-drawn foam chemical engine (figs. 22 and 23) operates the same as the

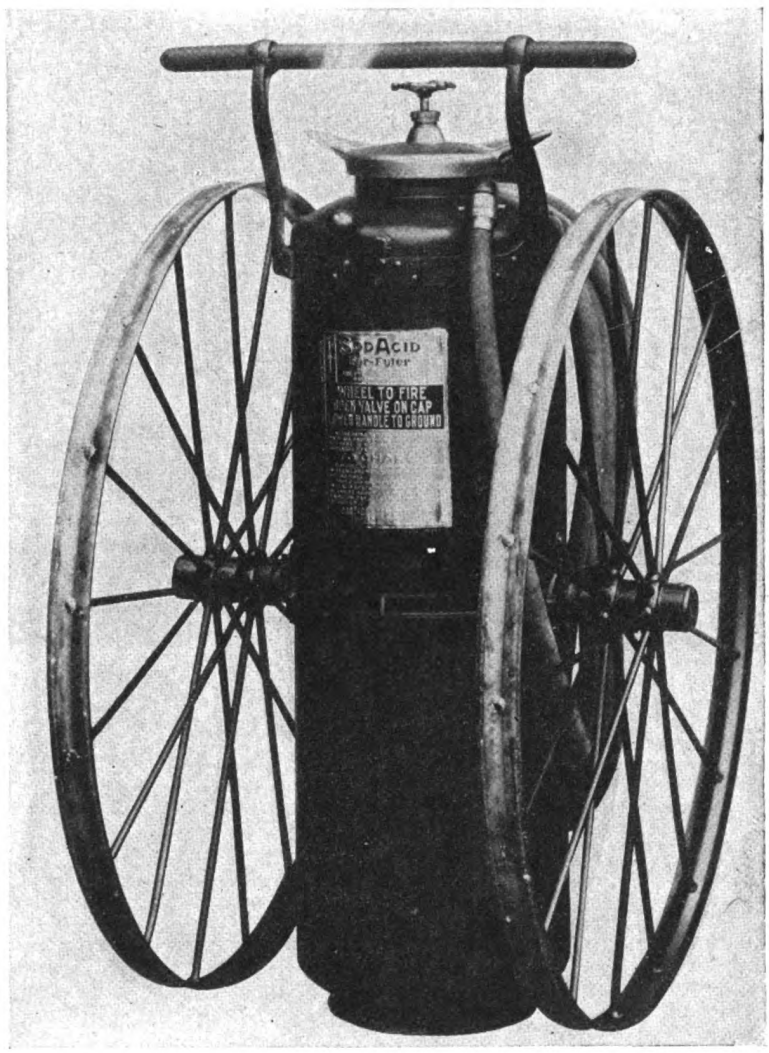

Figure 20. Narrow-tread hand-drawn soda-acid engine, 40-gallon capacity.
(Stock No. 58–4142.500–500.)

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Figure 21. Standard-tread hand-drawn soda-acid engine, 40-gallon capacity.
(Stock No. 58–4142.510–500.)

2½-gallon foam type except that it has greater capacity and is mounted on wheels. The narrow-tread engine has an over-all width of 30 inches to negotiate narrow passageways inside buildings; the standard-tread type is approximately 48 inches wide and is designed for outdoor use.

37. Charging

a. 2½-GALLON SODA-ACID EXTINGUISHER. To recharge the 2½-gallon soda-acid extinguisher, wash out the interior of shell and acid bottle. (See fig. 24.) *Be sure all water or acid is out of acid bottle before acid or water is added.* Dissolve 1½ pounds of bicarbonate of soda in 7 quarts of lukewarm water. Pour solution into extinguisher and add fresh water to level of special marker on inner wall of extinguisher. The extinguisher filled to the top of the collar holds 3 gallons but must never be charged with more than 2½ gallons of liquid. Pour 4 fluid ounces of concentrated sulfuric acid into acid bottle; fill to plainly etched line in glass around center of bottle, which shows the 4-ounce level.

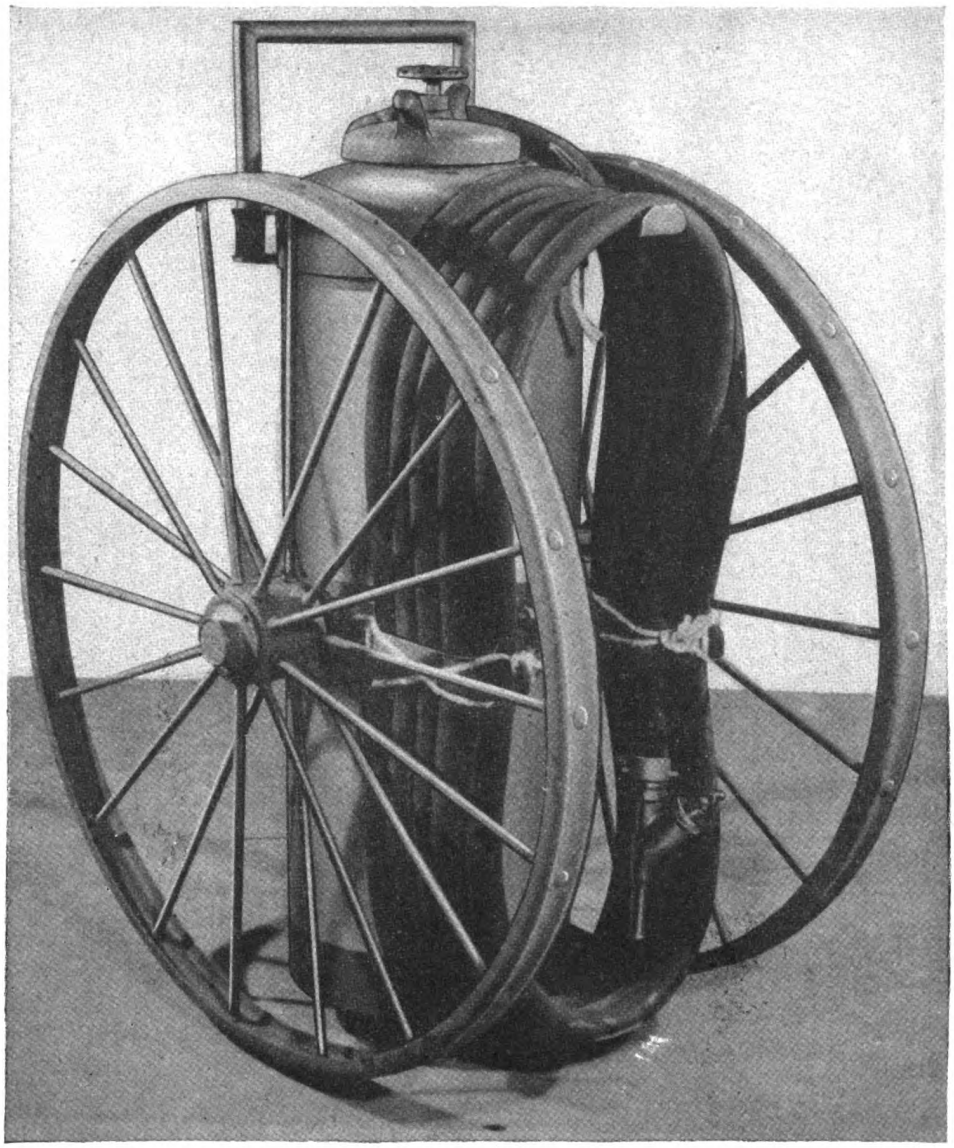


Figure 22. Narrow-tread hand-drawn foam engine, 40-gallon capacity.
(Stock No. 58–4142.200–500.)

Caution: *Never put more than 4 ounces of sulfuric acid in the acid bottle.*

Insert lead stopper in acid bottle and place in cage; insert cage and bottle in extinguisher. Be sure the lead stopper and bottle are designed for the extinguisher being recharged because acid bottles, cages, and lead stoppers made by different manufacturers vary slightly and may not operate in the wrong extinguisher. Next examine the gasket in the cap. If it is ridged or defective, put in a new gasket. Screw the cap down on the collar handtight.

b. 2½-GALLON FOAM EXTINGUISHER. Charges for the 2½-gallon foam extinguisher are made in exact proportions according to full instructions on packages. The usual charge comes in two packages, marked *A* and *B*. (See fig. 25.) Prepare the solutions outside the extinguisher. Dissolve the *A* package in exactly 2¼ pints of *hot water* and pour into inner chamber. Dissolve the *B* package in exactly 1¾ gallons of *lukewarm water* and pour into outer chamber. Do not use hot water with *B* package because heat deteriorates it. Use only charges recommended by the manufacturer.

c. 40-GALLON HAND-DRAWN SODA-ACID CHEMICAL

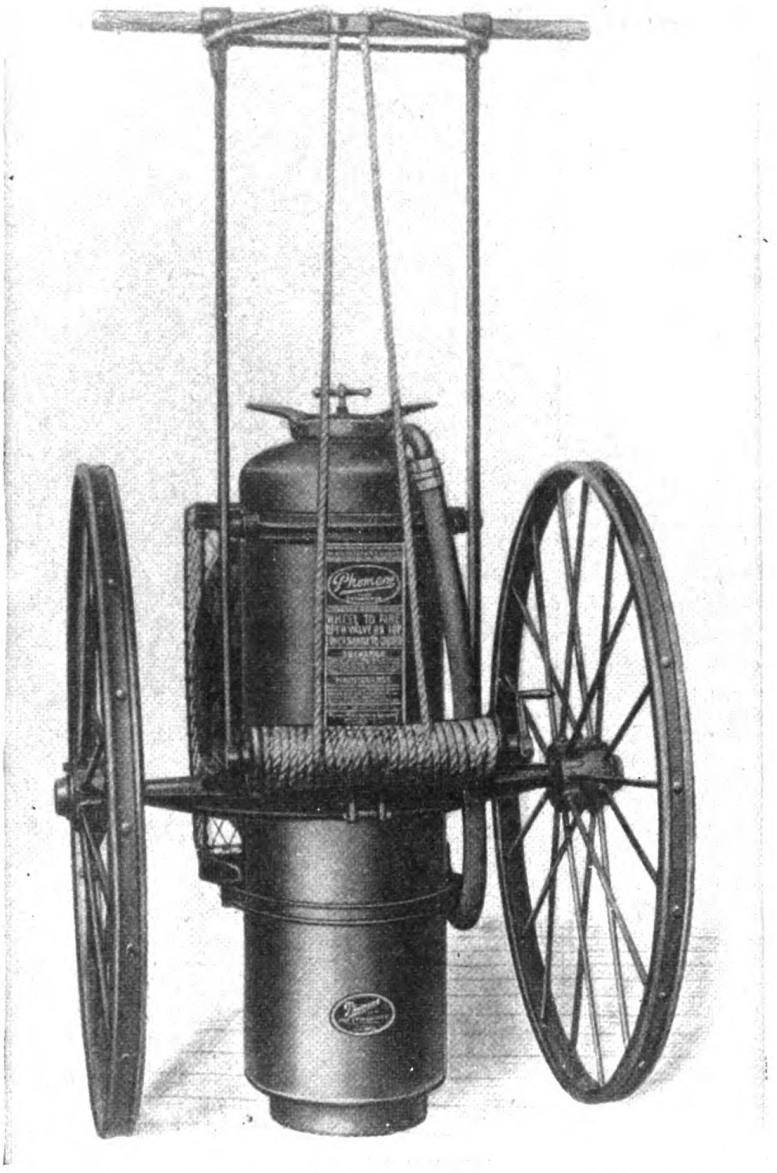


Figure 23. Standard-tread hand-drawn foam engine, 40-gallon capacity. (Stock No. 58–4142.210–500.)

ENGINE. The hand-drawn soda-acid chemical engines known commercially as 40-gallon engines actually carry only 33 gallons of water. The chemicals used are 20 pounds of bicarbonate of soda and 7 pounds of sulfuric acid. The method of charging is the same as for the 2½-gallon soda-acid type; the same precautions apply.

d. 40-GALLON HAND-DRAWN FOAM CHEMICAL ENGINE. The 40-gallon hand-drawn foam chemical engines use specially prepared charges, marked *A* for the inner container and *B* for the outer container. (See fig. 26.) Full instructions are printed on each package; follow these instructions exactly to insure proper functioning.

38. Inspection and Maintenance of Soda-acid Types

a. MONTHLY. Make the following checks on soda-and-acid extinguishers monthly:

(1) *General.* (*a*) Examine surroundings to make

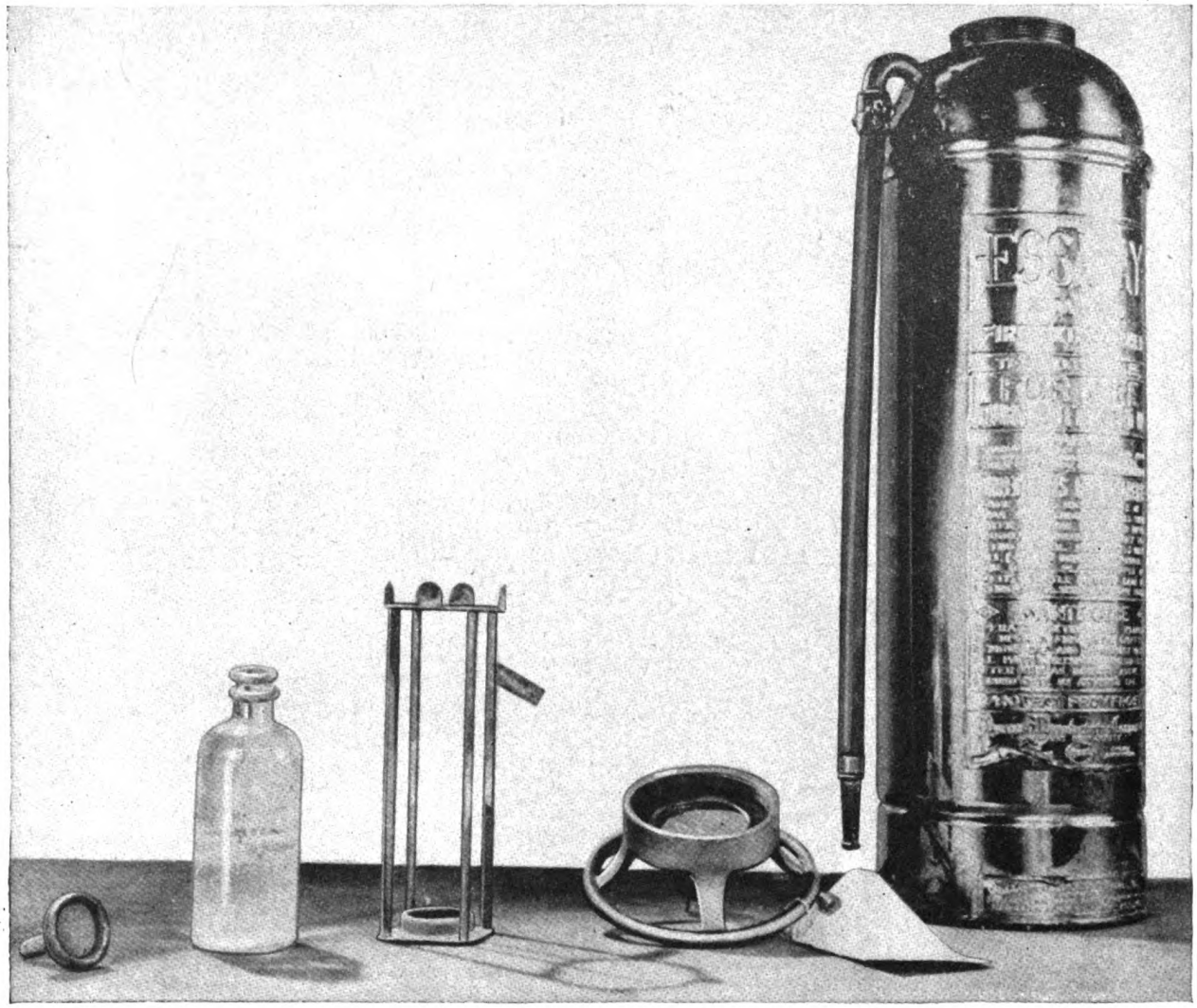


Figure 24. Disassembled soda-acid extinguisher.

sure extinguisher is readily accessible and not subject to mechanical injury. Have all obstructions removed.

(*b*) Check for new fire hazards in protection area; change type of extinguisher or add new units if necessary.

(*c*) See that extinguishers are correctly placed to meet established criteria.

(*d*) Check hanging bracket or support for security, replace, tighten, or strengthen it if necessary.

(*e*) Check serial number on extinguisher to see that original installation has not been changed. Only authorized personnel may make changes.

(2) *Hose and nozzle assembly.* (*a*) If signs of stoppage are evident in nozzle, check carefully to insure proper operation.

(*b*) Inspect hose for deterioration, cracking, or other signs of failure. Obtain hose-assembly replacement from manufacturer.

(*c*) Check nozzle diameter to insure that no foam type nozzles are used on soda-and-acid extinguishers. Diameter of soda-and-acid extinguisher nozzle is ⅛ inch.

(3) *Extinguisher tank.* Check tank for external corrosion or damage. Replace weakened tanks which may be ruptured by pressure when in operation.

(4) *Contents.* (*a*) Check for proper amount of fluid by weight or by checking seals on units sealed

Figure 25. Disassembled foam extinguisher, showing packages of chemicals, used to recharge inner and outer chambers.

to wall. Report discharged extinguishers to fire department immediately.

(*b*) If extinguisher has been exposed to freezing temperatures, inspect closely for damage. Replace damaged extinguishers with new ones.

(5) *Records.* Make proper notation on extinguisher tag. Replace with new tag if needed.

(6) *Forty-gallon type.* Check 40-gallon extinguishers, making applicable preceding inspections. If manually-operated stopper is used, see that it is screwed tight. Lubricate threads.

b. SEMIANNUALLY. Perform the following services semiannually:

(1) *Hose and nozzle assembly.* Remove cap and blow through nozzle to insure that waterway is unobstructed. A short hose or tube may be slipped over the nozzle for a mouthpiece.

(2) *Extinguisher tank.* (*a*) Remove cap and inspect interior of extinguisher tank visually. Replace faulty extinguishers with ones of equivalent capacity.

(*b*) Check filling collar for dents or foreign matter. If collar does not butt tightly against cap gasket to make a tight seal, replace extinguisher.

(3) *Contents.* (*a*) Remove cap and acid-bottle cage. Check quantity of soda solution by filler mark. Check for soda cake on bottom with small wooden stick, and recharge if excessive. Do not scratch lead coating on interior of extinguisher.

(*b*) Check quantity of acid; excess indicates water absorption and need for fresh acid. Extinguishers subject to alternate hot and cold temperatures are more likely to have acid weakened by water absorption.

(*c*) Inspect gasket for breaks or groove worn by filling-neck collar. Replace if necessary.

(*d*) Examine acid-bottle stopper for freedom of movement. Replace bottles or stoppers that bind with type designed by original manufacturer.

(*e*) Check acid bottle for cracks and cage holder for weak spots. In replacing cages, use those supplied by manufacturer.

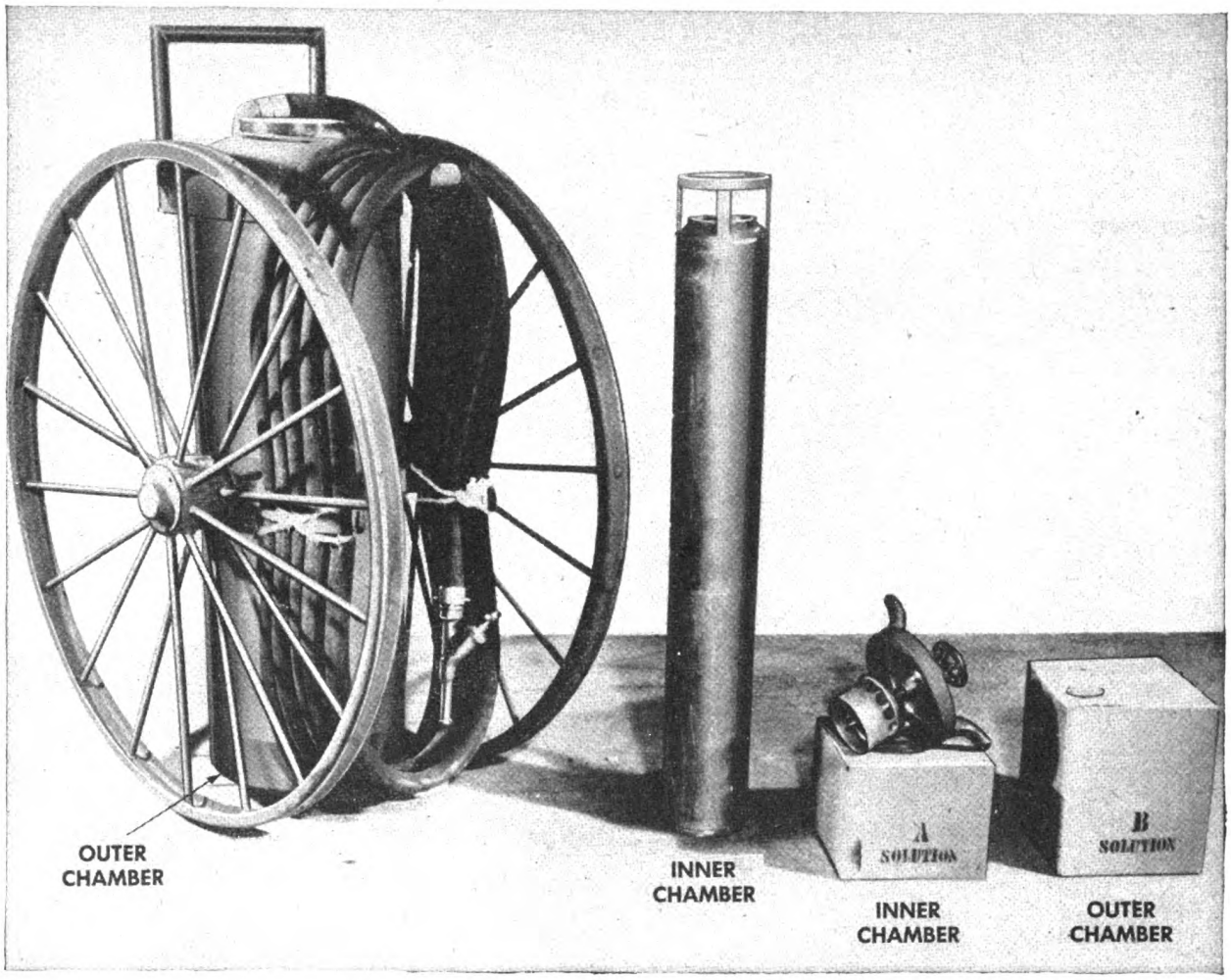


Figure 26. Disassembled foam chemical engine.

(4) *Records.* Make appropriate entry in record books of fire department.

(5) *Forty-gallon type.* (*a*) Check 40-gallon extinguisher, making applicable preceding inspections. Check shut-off nozzle for proper operation. If major repair is needed, get standard replacements.

(*b*) Check hose for proper coiling, recoiling hose if necessary to insure against dragging when extinguisher is moved.

(*c*) Lubricate running gear.

c. ANNUALLY. Discharge and recharge all soda-and-acid types annually. In addition, perform the following services:

(1) *Hose and nozzle assembly.* After discharge, thoroughly flush hose and nozzle with clear water.

(2) *Extinguisher tank.* Examine tank interior for signs of weakness. Take substandard extinguishers out of services; do not attempt repairs.

(3) *Contents.* When discharging, observe range of stream, determining cause of improper operation. Recharge as explained in paragraph 37.

39. Inspection and Maintenance of Foam Types

a. MONTHLY. Service foam type extinguishers monthly as follows:

(1) *General.* Follow procedure described in paragraph 35*a*(1) for general inspection of extinguisher.

(2) *Hose and nozzle assembly.* (*a*) Examine nozzle for external signs of stoppage. Contents of foam type extinguisher plug the nozzles easily. If any stoppage is seen, make complete inspection.

(*b*) Inspect hose for deterioration, cracking, or

other signs of failure. Obtain hose-assembly replacements from manufacturer.

(*c*) Check nozzle diameter to insure that no soda-acid nozzles are installed. Foam-nozzle diameter is $\frac{3}{16}$ inch.

(3) *Extinguisher tank.* Follow procedure given in paragraph 38*a*(3) for servicing extinguisher tank.

(4) *Contents.* Check for proper amount of fluid by weight or by checking seals on units sealed to wall. Report discharged extinguishers to fire department immediately.

(5) *Records.* Check tag as described in paragraph 38*a*(5).

(6) *Forty-gallon type.* (*a*) Service 40-gallon extinguishers, making applicable preceding inspections. Examine shut-off nozzle for proper operation. Replace faulty nozzle and hose assemblies with new standard replacement units.

(*b*) Check hose coil for security and signs of failure.

b. SEMIANNUALLY. Make the following checks semiannually:

(1) *General.* Perform general services described in paragraph 35*a*(1).

(2) *Hose and nozzle assembly.* Service hose and nozzle assembly using procedure in paragraph 38*b*(1).

(3) *Extinguisher tank.* Remove cap and examine tank interior visually.

(4) *Contents.* (*a*) Remove cap and inner chamber. Inspect inner chamber for corrosion; check quantity and quality of contents. Take necessary precautions to avoid chipping porcelain inner chamber on Victory models which were constructed of wartime substitute materials.

(*b*) Check quantity and quality of inner-chamber solutions. Replace or recharge inner and outer chambers as required.

(*c*) Check inner-chamber stopper for freedom of movement, permitting no binding.

(*d*) Look for gasket breaks or deep grooves worn by filling collar which may cause leaks; replacing gasket if necessary.

(*e*) Examine filling collar for dents or foreign matter. Filling collar and gasket must fit snugly to prevent leakage. Recharge as described in paragraph 37.

(*f*) *Forty-gallon type.* Lubricate running gear of 40-gallon extinguishers.

(5) *Records.* Complete records following procedure in paragraph 38*a*(5).

(6) *Forty-gallon type.* On outdoor type 40-gallon extinguishers, check rope for signs of weakness and replace if necessary.

c. ANNUALLY. Discharge and recharge all foam types annually. In addition, service as follows:

(1) *Hose and nozzle assembly.* Check hose and nozzle assembly, using procedure in paragraph 38*c*(1).

(2) *Extinguisher tank.* Service extinguisher tank, following procedure in paragraph 38*c*(2). Take special precautions with substitute standard models produced during war period and containing noncritical materials which may have been inferior.

Section V. CARBON TETRACHLORIDE EXTINGUISHERS

40. Types

Carbon tetrachloride extinguishers contain a vaporizing liquid, known by Federal specification as fire-extinguisher liquid, carbon tetrachloride base. It consists of specially purified carbon tetrachloride with other chemicals added to lower the freezing point to about —50° F. This liquid is a nonconductor of electricity; in contact with fire or hot surfaces it develops a heavy gas which replaces the oxygen and smothers the fire. Commercial grades of carbon tetrachloride, known as carbon tetrachloride technical, will not be used as fire extinguisher liquid. When using extinguishers of this type, especially in unventilated spaces such as small rooms, closets, or confined spaces, precautions must be taken to avoid breathing the gases produced. (See par. 30.)

a. ONE-QUART PUMP TYPE HAND EXTINGUISHERS. The 1-quart carbon tetrachloride extinguisher (fig. 27) has a cylindrical brass container with a double-acting pump inside. Pick-up tubes are arranged to discharge liquid when the extinguisher is held in any position.

b. ONE-GALLON STORED-AIR HAND EXTINGUISHER. The 1-gallon extinguisher (fig. 28) has a steel (Victory model) or copper outer shell, one inner container for stored air under pressure, and a double-acting pump inside the inner container. The liquid, not normally under pressure, is discharged by turning a small handwheel on top of the extinguisher to open

Figure 27. Carbon tetrachloride extinguisher, 1-quart capacity. (Stock No. 58–4276.300–003.)

Figure 28. Carbon tetrachloride extinguisher, 1-gallon capacity. (Stock No. 58–4276.300–010.)

two valves. One valve allows air to escape from the air chamber to the liquid chamber; the other opens the liquid chamber to the discharge hose. A gauge shows the air pressure; the peak hole or sight glass shows the liquid level. Another valve permits air pressure to be obtained either by pumping from attached hand pump or from outside air supply.

c. THREE AND ONE-HALF-GALLON STORED AIR HAND-DRAWN EXTINGUISHER. The 3½-gallon hand-drawn extinguisher (fig. 29) is identical with the 1-gallon type except that it has greater capacity, a longer discharge hose, and is mounted on wheels.

41. Charging

The 1-quart pump type extinguisher is charged with 1 quart of fire-extinguisher liquid, carbon tetrachloride base. The 1-gallon and 3½-gallon stored-pressure types have 1 and 3½ gallons of this liquid, respectively, in their outer compartments and air under 100 pounds pressure in the inner compartments. Air pressure may be supplied by built-in hand pump or available outside source. Ordinary commercial carbon tetrachloride is unsuitable for fire extinguisher recharging. The standard fire-extinguishing carbon tetrachloride solution, and the

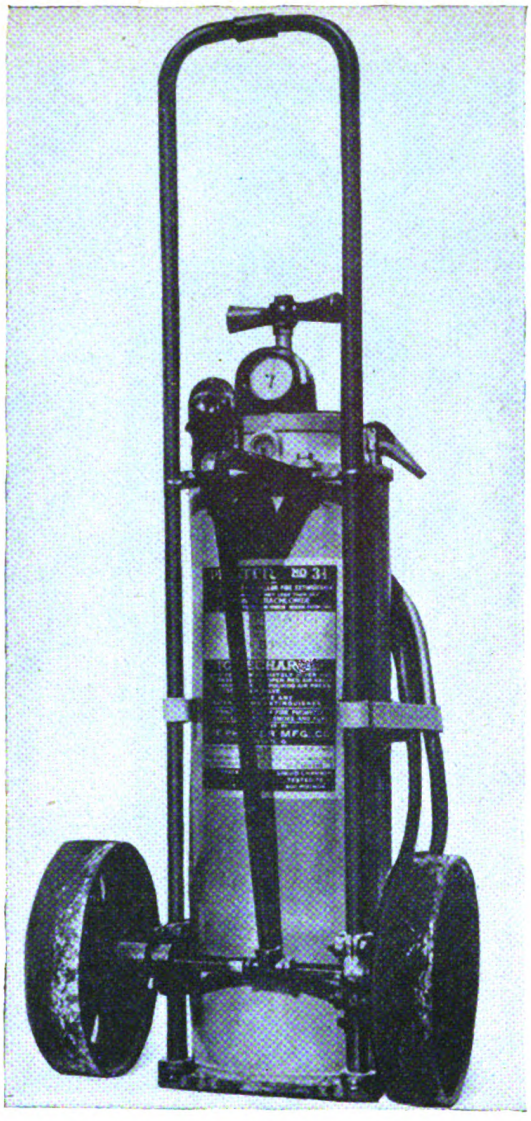


Figure 29. Carbon tetrachloride hand-drawn chemical engine, 3½-gallon capacity.
(Stock No. 58–4276.350–035.)

extinguishers during recharging, must be kept entirely free of any traces of moisture to avoid serious corrosion.

42. Inspection and Maintenance

a. MONTHLY. Service carbon tetrachloride extinguishers monthly as follows:

(1) *General.* Perform general services outlined in paragraph 35*a*(1).

(2) *Extinguisher.* (*a*) Examine nozzle opening for stoppage or leakage; notify fire department of faulty nozzles. Fire department personnel may clear obstructions by operating extinguisher, catching fluid in clean glass container for return to chamber.

(*b*) Check 1-quart type for leakage. Leakage may be caused by air pressure, which may be relieved by removing filler cap. If this does not remedy trouble, replace extinguisher.

(*c*) Stop leakage on 1-gallon and 3½-gallon types by closing valve; replace extinguishers if leakage cannot be stopped.

(*d*) Check hose for deterioration, cracking, or other signs of failure. Procure hose assembly replacements from manufacturer.

(*e*) Inspect for external corrosion or damage, replacing extinguishers showing signs of possible failure.

Caution: *Major* external repairs and *all* internal repairs must be made by trained personnel having special equipment.

(3) *Contents.* (*a*) See that any seals are unbroken. Seals are used to prevent any tampering.

(*b*) Make sure 1-quart types are full of fluid by tilting extinguisher to splash liquid.

(*c*) Check contents of 1-gallon and 3½-gallon types by sight gauge, tilting extinguisher to move liquid against glass so level of liquid can be readily determined. Fill to correct level if necessary.

(*d*) Check air-pressure gauge on 1-gallon and 3½-gallon types. Bring pressure to 100 pounds by pump or outside source.

(4) *Records.* Note inspection on tag. Replace tag if lost.

b. SEMIANNUALLY. Make the following checks semiannually:

(1) *General.* Perform general services described in paragraph 35*b*(1).

(2) *Extinguisher.* Lubricate running gear on 3½-gallon size.

(3) *Contents.* Discharge some fluid into clean glass container to test for proper operation. Replace fluid used for test. Refill fire extinguisher if necessary.

Caution: Do not contaminate fluid with moisture, which corrodes the unit and causes failure.

(4) *Records.* Record inspection properly in fire department records.

Section VI. CARBON DIOXIDE GAS EXTINGUISHERS

43. Types

Two types of carbon dioxide gas extinguishers are regularly issued: 15-pound hand type (fig. 30) and 50-pound hand-drawn wheeled type (fig. 31). However, 2-, 4-, 7½-, 10-, and 20-pound hand types and 77- and 100-pound hand-drawn wheeled types are also in service. (See fig. 32.) These units have a steel cylinder for liquefied carbon dioxide, an operating valve, and discharge hose and horn. The pressure in carbon dioxide extinguishers varies with the outside temperature, cylinder pressure being

Figure 30. Carbon dioxide hand extinguisher, 15-pound capacity. Regularly issued at military installations. (Stock No. 58–4276.200–150.)

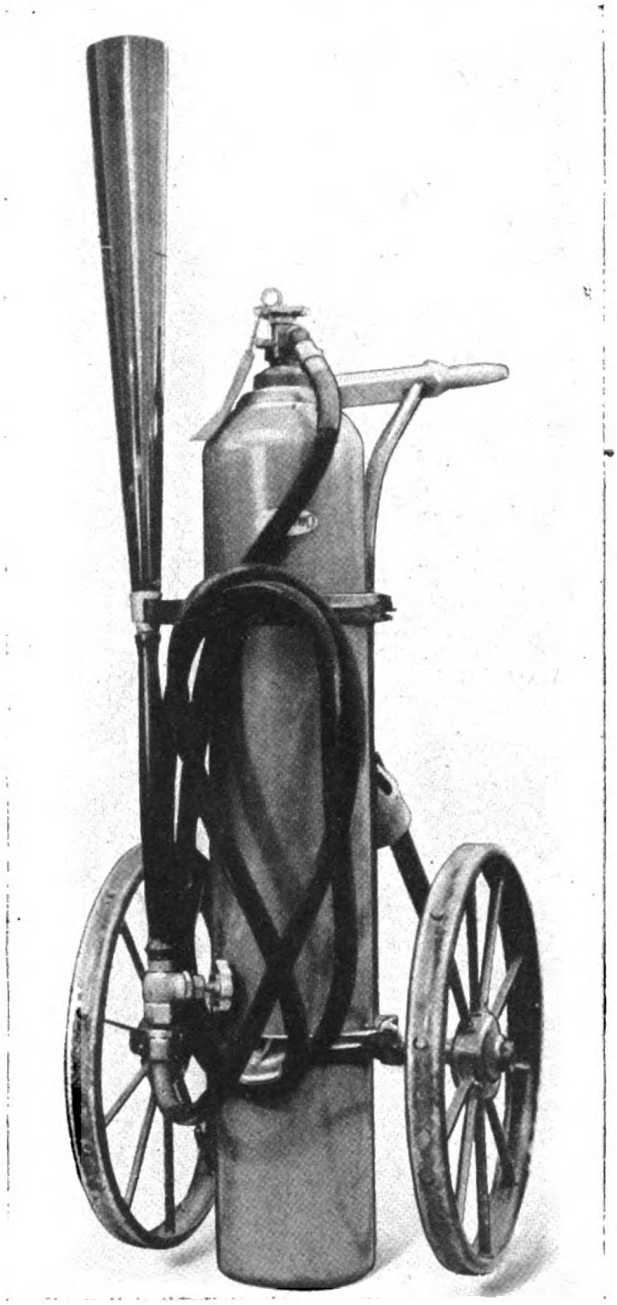
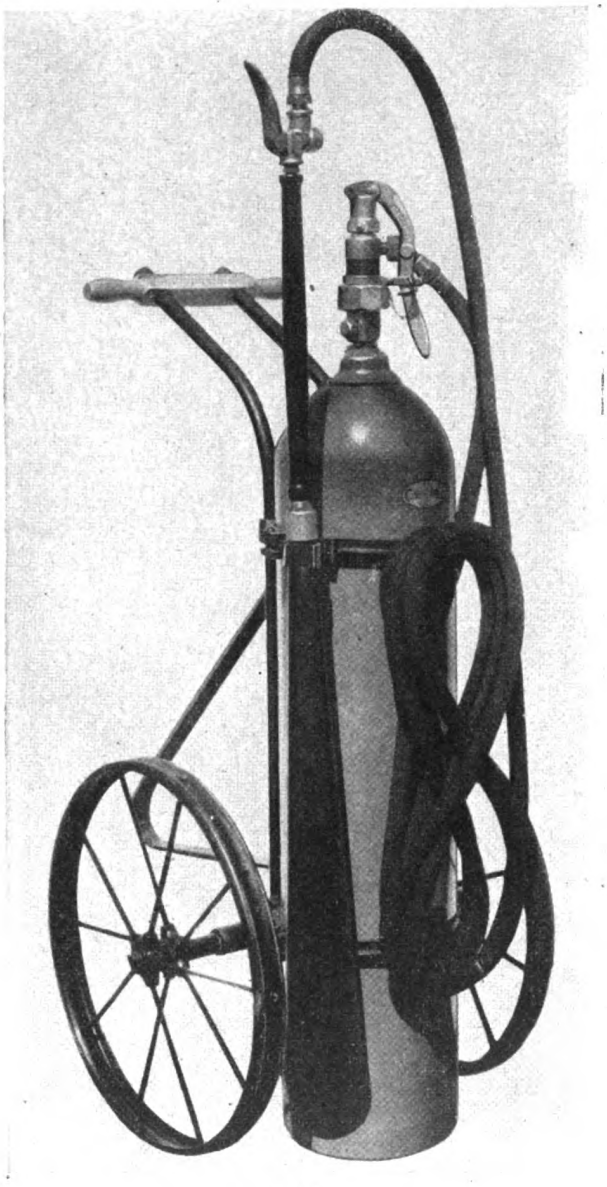


Figure 31. Carbon dioxide hand-drawn chemical engine, 50-pound capacity. Regularly issued at military installations. (Stock No. 58–4276.200–500.)

103 pounds per square inch (psi) at −50° F., 285 psi at 0° F., 834 psi at 70° F., 1,450 psi at 100° F., 2,530 psi at 140° F., and 3,090 psi at 160° F. Therefore, carbon dioxide extinguishers should not be installed near heating equipment and must be protected from the direct sun rays during hot weather. Conversely, discharge pressure is materially less in subzero operation. When using these extinguishers, especially in unventilated spaces, such as small rooms, closets, or confined spaces, personnel must use caution to avoid breathing excessive gases produced. A siphon tube connected to the outlet valve is incorporated in manufacture to expel liquid carbon dioxide from the bottom of the extinguisher. This requires that the extinguisher be in a nearly upright position while discharging and not lying on its side.



① *Figure 32. Various other carbon dioxide types, ranging from 2-pound to 100-pound sizes.*

a. FIFTEEN-POUND HAND EXTINGUISHER. The 15-pound hand extinguisher has a container of liquefied carbon dioxide, fitted with a special quick-opening valve which releases gas through a hand hose and specially designed nozzle-and-horn assembly. When liquid carbon dioxide is released into the horn, it changes to a gas almost instantaneously. Carbon dioxide gas is inert and slightly heavier than air, blanketing the fire by excluding the oxygen.

b. FIFTY-POUND HAND-DRAWN WHEEL TYPE EXTINGUISHER. The 50-pound hand-drawn wheel type extinguisher operates like the 15-pound type. It has a larger cylinder and horn, a longer discharge hose, and is mounted on wheels.

44. Charging

All carbon dioxide extinguishers must be provided with two seals: one, a piece of fine copper wire with lead seal attached to the valve handle or wheel; the other, a plastic hood placed over the safety valve. Install plastic seals used to cover the frangible pressure-release disk by soaking in water until they become soft and pliant. Then put them in place and allow to dry before the extinguisher is returned to service. These seals, made of special materials, must be standard replacement items as designed by the manufacturers of carbon dioxide extinguishers to insure proper operation. Recharge extinguishers when they fall below 10 percent of rated weight capacity. Depending on the facilities available, transfer pumps, bypass filling units, dry-ice converters, or commercial charging plants are used to charge all types of carbon dioxide hand and wheeled type extinguishers.

a. COMMERCIAL CHARGING PLANTS. Send extinguishers to the nearest commercial charging plant if adequate facilities are not available on the post. A list of charging plants for this work is usually furnished by the manufacturer with each extinguisher.

b. TRANSFER PUMPS. The transfer-pump unit has a small high-pressure pump, electric or gasoline motor, scales, spare 50-pound commercial cylinders,

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Figure 32. Various other carbon dioxide types, ranging from 2-pound to 100-pound sizes—Continued.

tilting rack, and necessary piping and fittings. Because the unit pumps carbon dioxide in liquid form only, the amount of liquid in a fully charged cylinder varies with pressure and temperature. A standard commercial 50-pound cylinder contains approximately 38 pounds of liquid carbon dioxide and 12 pounds of gas at 70° F. With a transfer pump, the cooler the supply cylinder and extinguisher cylinder being recharged, the more efficient the transfer becomes. Moreover, the time required to charge an empty cylinder increases with the temperature of the cylinders. All cylinders should be kept as cool as possible. Follow the instructions below when recharging cylinders with transfer pumps.

(1) *General instructions.* (*a*) When starting pump after unit has been idle for some time, allow it to run for about 2 minutes to work oil into bearings before starting charging operations.

(*b*) When recharging an extinguisher cylinder, it is desirable to invert it to keep it cooler and permit faster filling. (See fig. 33.) Larger cylinders which cannot be easily inverted may be placed horizontally on the scale, if possible with the bottom of the extinguisher blocked up. If the supply cylinder has a siphon tube, it need not be inverted.

(*c*) Efficient transfer stops after all the liquid carbon dioxide, approximately 80 percent of the net contents, is transferred from the supply cylinder. Use a new, fully charged supply cylinder to bring the extinguisher cylinder to full-rated capacity. Most of the gas in the other supply cylinder can be used to start another empty extinguisher cylinder, the gas transferring itself under its own pressure until the pressure in both cylinders is equal.

(*d*) When ordering supply cylinders from commercial manufacturers of carbon dioxide, specify a normal discharge-outlet opening of at least $\frac{1}{8}$-inch diameter and a valve-passage opening of $\frac{3}{16}$-inch

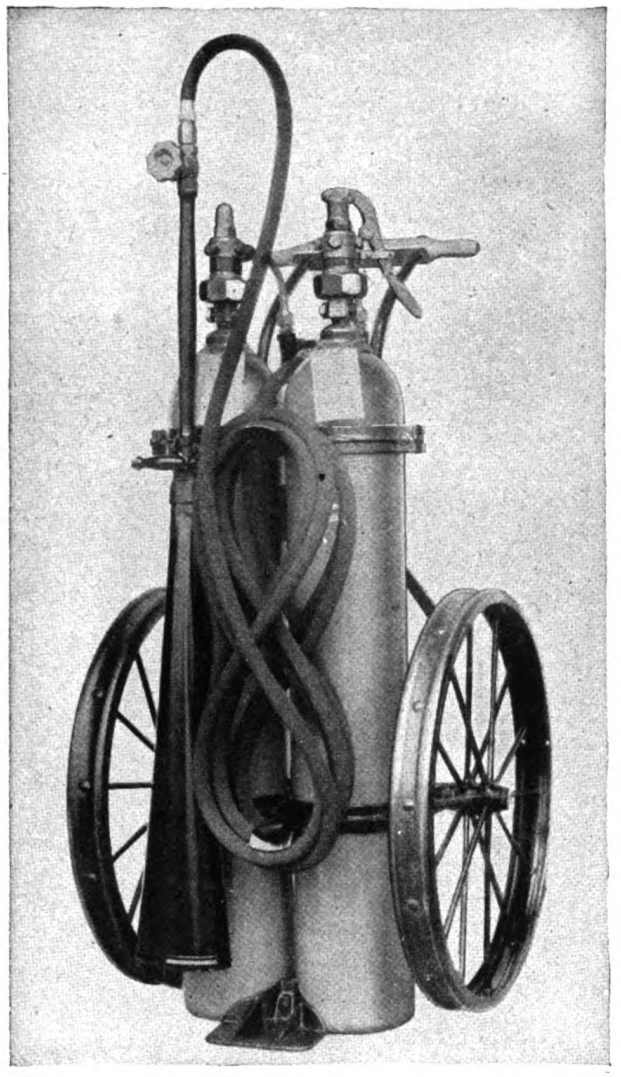

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Figure 32. Various other carbon dioxide types, ranging from 2-pound to 100-pound sizes—Continued.

diameter. These measurements prevent the expansion of carbon dioxide in the supply hose, which clogs it with carbon dioxide snow.

(*e*) Use only sealing and safety disks which are standard replacement items designed by the manufacturer of the particular extinguisher being recharged.

(*f*) Always store carbon dioxide cylinders in a cool place.

(*g*) Use the transfer unit for carbon dioxide only, not for oxygen or other gases.

(2) *Preparation.* (*a*) With transfer unit, scale, and tilt racks in place, check the supply cylinder. If supply cylinder has no siphon tube, place it in rack, tighten with chain securely about cylinder, and invert. If supply cylinder has a siphon tube, use it in a vertical position.

(*b*) Connect pump inlet hose to supply-cylinder outlet. Connection adapter of this hose is fitted with screen to keep foreign matter from transfer unit or cylinder being recharged. Do not open supply-cylinder valve.

(*c*) Complete procedures for extinguishers with valves of seat and disk type, including use of adapters of filling bonnets and sealing disks for recharging, are given in (5)(*a*) and (*b*) below. See these instructions before proceeding with the following steps.

(*d*) Connect pump outlet hose to filling bonnet or recharging adapter on the cylinder to be recharged. The pump outlet hose has a shut-off valve.

(*e*) *Check all connections to insure they are properly and securely made.* When making connections, use a 12-inch wrench with a slow, steady pull. Do not jerk or hit wrench with a hammer.

(*f*) Be sure shut-off valve in pump outlet hose is in tightly *closed* position and valve or filling bonnet of cylinder being recharged is in *open* position.

(*g*) Set up empty cylinder on scale. If cylinder is of moderate capacity, it may be readily inverted on the scale by a rack. Very heavy cylinders may be placed on scale in a horizontal position.

(*h*) Carefully determine net capacity and total weight of extinguisher to be recharged; set scale at fully charged weight shown on cylinder record tag and stamped on side of cylinder valve, cylinder or nameplate band.

(3) *Charging.* (*a*) Open valve of supply cylinder fully.

(*b*) Open shut-off valve in pump outlet hose, allowing carbon dioxide in supply cylinder to transfer to cylinder being recharged under its own pressure.

(*c*) After flow has stopped under its own pressure (weight of cylinder being recharged becomes constant), start transfer unit and watch scale carefully.

(*d*) When full capacity is reached, perform the following operations in rapid succession:

1. Stop transfer-unit motor.
2. Tightly close shut-off valve in pump outlet hose.

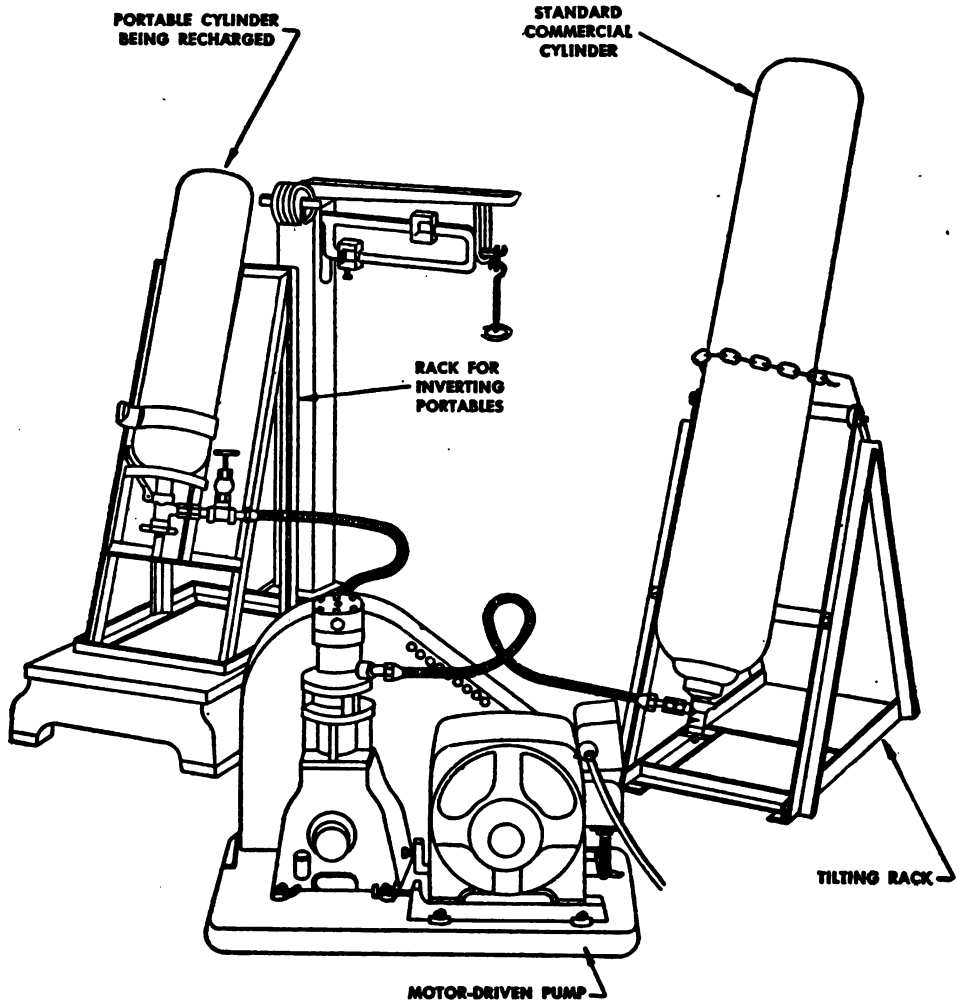


Figure 33. Transfer pump in operation.

3. Close filling bonnet or valve of cylinder being recharged. (See (5)(*a*) and (*b*) below for correct procedure.)

Caution: *Do not close filling bonnet, valve of cylinder being recharged, or shut-off valve in pump outlet hose while transfer unit is pumping.*

(4) *Disconnecting.* (*a*) Disconnect hose from cylinder being recharged very slowly to allow pressure trapped between shut-off valve and cylinder being recharged to escape. Then remove filling bonnet or adapter.

(*b*) Weigh recharged cylinder carefully.

(*c*) After recharging is complete, close supply-cylinder valve tightly and open shut-off valve in pump outlet hose very slowly, allowing all gas in pump to discharge.

(*d*) Install plastic safety seal. (See (1)(*e*) above.)

(5) *Special instructions.* (*a*) For recharging type B, seat type valve (fig. 34):

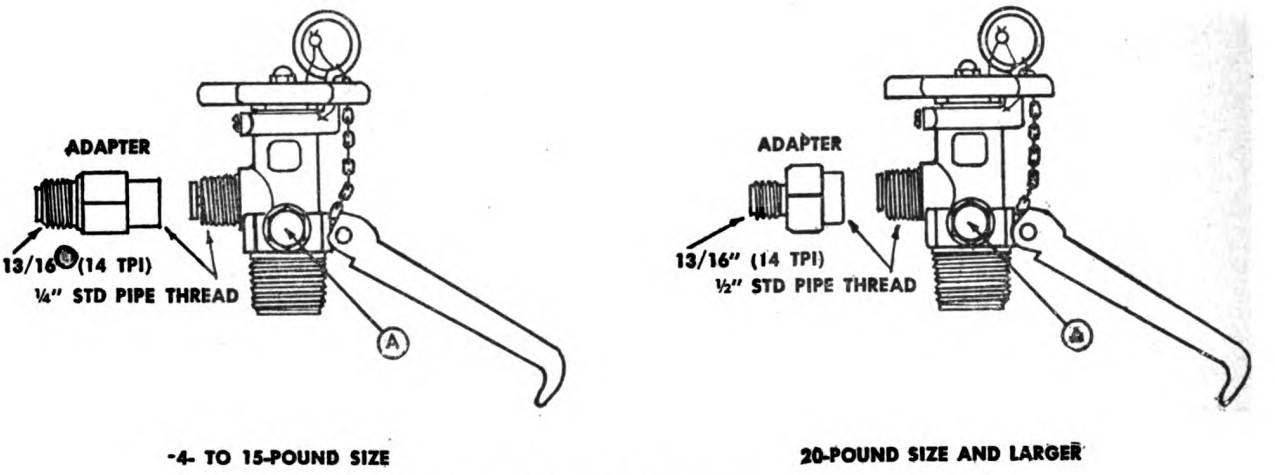
1. For the 2-pound unit, unscrew horn from tube, using wrench on flats of horn nut. Attach adapter to end of tube and connect to gas supply. For 4-pound to 20-pound units, unscrew tube and discharge-horn assembly at cylinder-valve connection. Attach adapter to cylinder-valve connection and connect to gas supply.

2. Turn handwheel to open extinguisher valve.

3. Fill cylinder with proper weight of gas.

4. Turn handwheel and close valve tightly.
5. Loosen setscrew of adjustable ring or collar under handwheel. Turn collar until hole in collar and handwheel align before inserting locking pin. Then tighten setscrew of lock-pin ring.
6. Attach lead seal and wire to locking pin and test for leaks under water.
7. If cylinder valve cannot be shut tightly by hand, tap handwheel *lightly* with a small hammer.
6. Unscrew filling bonnet, and test entire cylinder-valve assembly for leakage under water.
7. See that cutter is not damaged and has a sharp edge. Insert locking pin in handwheel of cutter head. Attach lead seal and wire.
8. Attach cutter head to cylinder valve and tighten lightly with wrench.

(6) *Maintenance of transfer unit.* Because different transfer pumps vary to some extent, no detailed maintenance instructions are given in this manual.



-4- TO 15-POUND SIZE — 20-POUND SIZE AND LARGER

Figure 34. Parts for seat-valve extinguisher.

(*b*) For recharging type A, disk type valve (fig. 35):

1. *Unscrew cutter head* engaging cylinder valve with left-hand thread.
2. *Unscrew disk bushing* with special wrench from filling bonnet. See that disk seat in cylinder valve is clean.
3. Screw disk bushing in cylinder valve until disk seats lightly.
4. Replace wrench in filling bonnet; seat wrench in slots of disk bushing and screw filling bonnet on cylinder valve.

Caution: Because filling bonnet has left-hand thread and disk bushing a right-hand thread, be sure in screwing bonnet on cylinder valve that disk bushing is not unscrewed. When filling bonnet is screwed down on cylinder valve firmly, back off on wrench, unscrewing disk bushing about 1½ turns.

5. Fill cylinder with proper weight of gas and screw disk bushing down tightly with special wrench in filling bonnet.

(*a*) Follow carefully directions furnished by the manufacturer for monthly lubrication and care of this equipment. All manufacturers publish complete operating instructions which can be obtained on request.

(*b*) For proper maintenance of electric motor, follow preventive maintenance procedures given for electric motors in TM 5–681.

(*c*) Examine all flexible pipe (hose) and fittings on transfer unit monthly and before use for signs of defects. Replace any item showing signs of weakness because high pressures in lines requires that all pipes and fittings be in perfect condition.

c. BYPASS FILLING UNIT. The carbon dioxide bypass filling assembly (fig. 36) recharges portable cylinders without using pumping equipment. The filling assembly is connected between a standard commercial cylinder and the portable extinguisher being recharged. Transfer of carbon dioxide using the

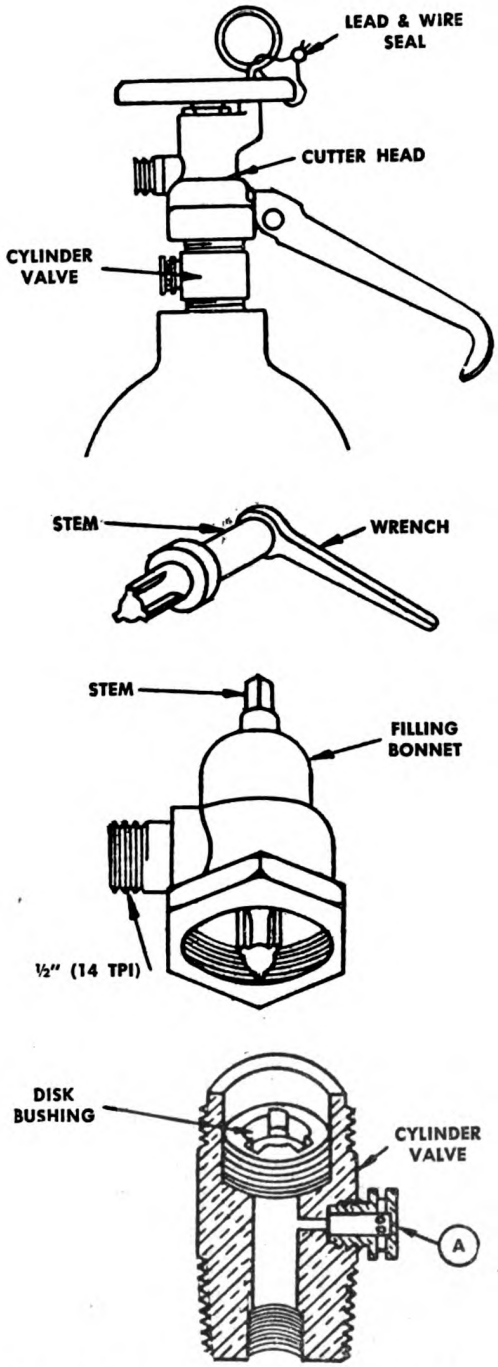


Figure 35. Parts for disk-valve extinguisher.

bypass method depends on a difference of temperature and corresponding difference in pressure between two cylinders. As gas is compressed in filling an empty fire extinguisher cylinder, that cylinder is heated; as gas under pressure leaves a supply cylinder, that cylinder is cooled. Therefore, a supply cylinder must be allowed to return to room temperature after recharging each hand extinguisher. Because it carries such high pressures, inspect this unit frequently for defects in hose and fittings and replace immediately any part showing weaknesses or defects.

(1) To recharge carbon dioxide portable units, use standard 50-pound carbon dioxide supply cylinders inverted and connected to the extinguisher by the bypass assembly. (See fig. 37.)

(2) Place extinguisher on a platform scale horizontally or preferably inverted. A spring-balance scale may be used instead of the platform scale. For more efficient transfer, see that extinguisher cylinder being recharged is kept cooler than the supply cylinder.

(3) With valve on extinguisher open, open valve on supply cylinder until a few pounds of carbon dioxide are admitted.

(4) Close valve on supply cylinder and open bypass valve in hose to allow carbon dioxide to flow out of portable extinguisher to atmosphere. This cools the extinguisher and permits a faster transfer of gas because of the difference in temperature between supply cylinder and extinguisher.

(5) Close bypass valve and open valve on supply cylinder again until extinguisher is filled. If extinguisher does not take a full charge, repeat operation in (4) above to cool cylinder further.

(6) Close valve on supply cylinder, then close valve on extinguisher. Bleed bypass filling assembly of gas and disconnect it.

(7) In practice, after two hand extinguishers are charged from a single supply cylinder, the pressure difference is enough for only a small amount of gas to enter a third cylinder. Use these nearly depleted supply cylinders to put a few pounds of carbon dioxide in an empty extinguisher. Then release this gas to atmosphere, cooling the extinguisher and providing enough temperature difference so carbon dioxide can flow down from a new supply cylinder at room temperature.

d. DRY-ICE CONVERTER. The dry-ice converter (fig. 38) is supplied in 300- and 600-pound sizes, both well suited for filling hand and wheel type extinguishers. This recharging method is probably the simplest of any described.

(1) *Procedure.* To recharge extinguishers with a dry-ice converter—

NOTE:
FOR TYPE A PORTABLES A FILLING-BONNET ASSEMBLY AND NEW SEALING-DISK BUSHING ARE ALSO REQUIRED

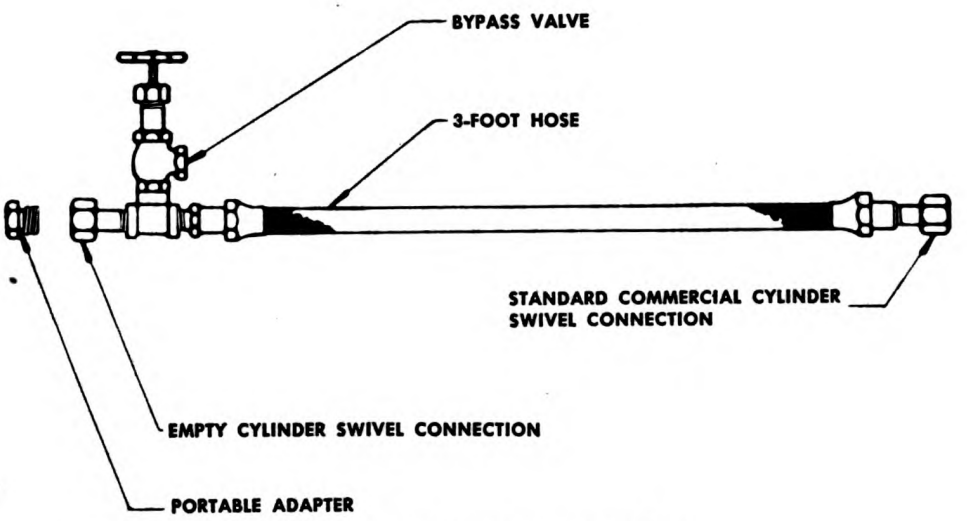


Figure 36. Bypass filling unit. (Stock No. 58–5410.500–500.)

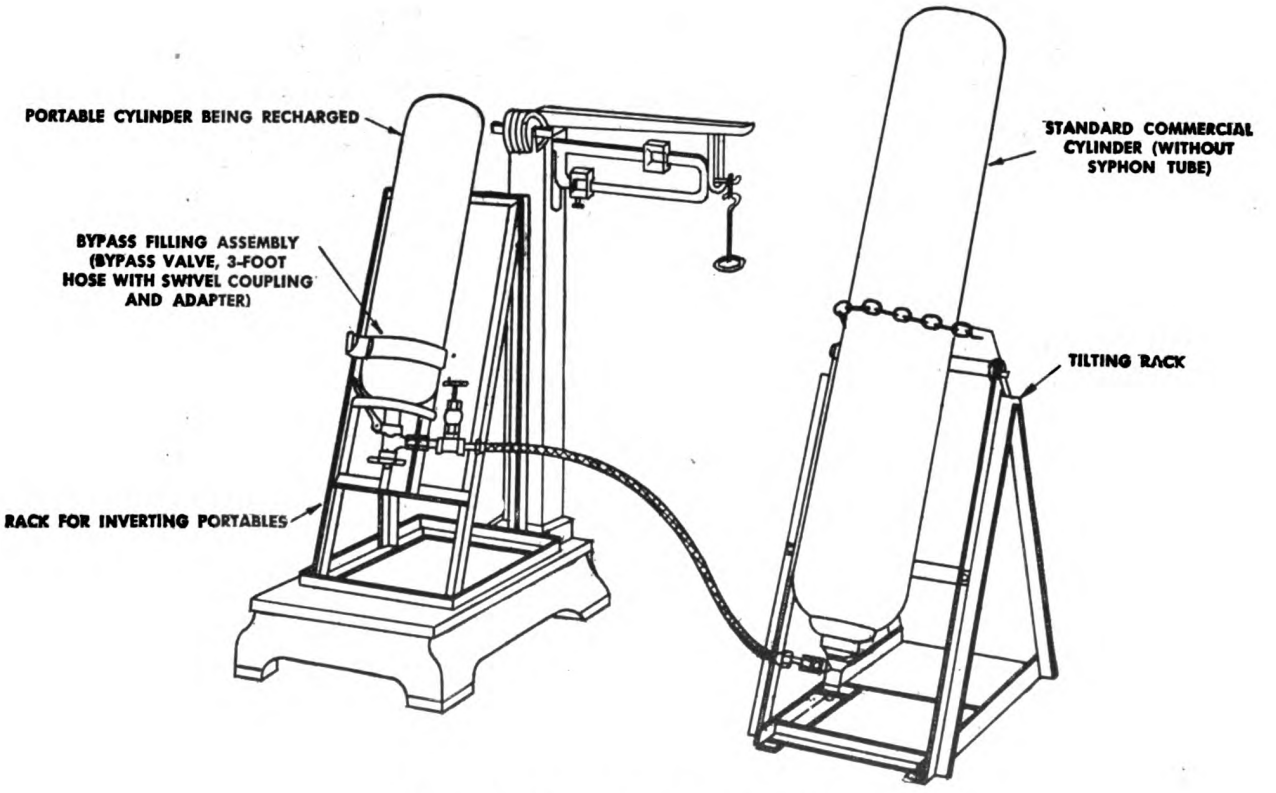


Figure 37. Bypass filling unit in operation.

(*a*) Fill one or more of the 150-pound converter tanks with dry ice and convert to liquid carbon dioxide by applying hot water outside the tank. As dry ice is converted, pressure rises until it is ample for filling extinguisher cylinders. Observe caution in applying hot water to control rate of pressure rise within limits of pressure-release safety disk.

(*b*) Place empty extinguisher cylinder on scale and weigh carefully. Add desired weight of carbon dioxide to weight of empty cylinder and set scale at that point.

(*c*) Make a pipe connection with the converter tank. When pipe-line valve is opened, carbon dioxide flows from tank to extinguisher. Close pipe-line valve when scale indicates that proper amount has been delivered. Close valve in extinguisher and disconnect pipe-line.

(*d*) Before attaching nozzle and horn, immerse discharge outlet in a glass of clear water to detect leakage in valve by bubbles rising from discharge outlet. After water test is made, dry valve carefully and attach nozzle, horn and seals. Extinguisher is now ready for service.

(2) *Maintenance.* Preventive maintenance of the conversion unit includes checking pipe and fittings for defects each time it is used. Because of high pressures carried, all components must be in perfect condition to avoid danger of mechanical or personnel injury caused by bursting tubing, hose, or connections. Inspections include a careful check of all threaded parts; if any worn or damaged threads are found, replace the part immediately. Because the calcium chloride in the dehydrator cylinder absorbs moisture from the carbon dioxide passing through, it must be replaced with fresh, dry calcium chloride at regular intervals. No definite interval can be prescribed because the amount of moisture absorbed varies considerably. Experienced operators learn to recognize when replacement is necessary by observing the slowing down of the transfer operation. Water in calcium chloride freezes, slowing down carbon dioxide transfer noticeably.

45. Inspection and Maintenance

a. MONTHLY. Service carbon dioxide extinguishers monthly as follows:

(1) *General.* Perform general services, using procedure in paragraph 35*a*(1).

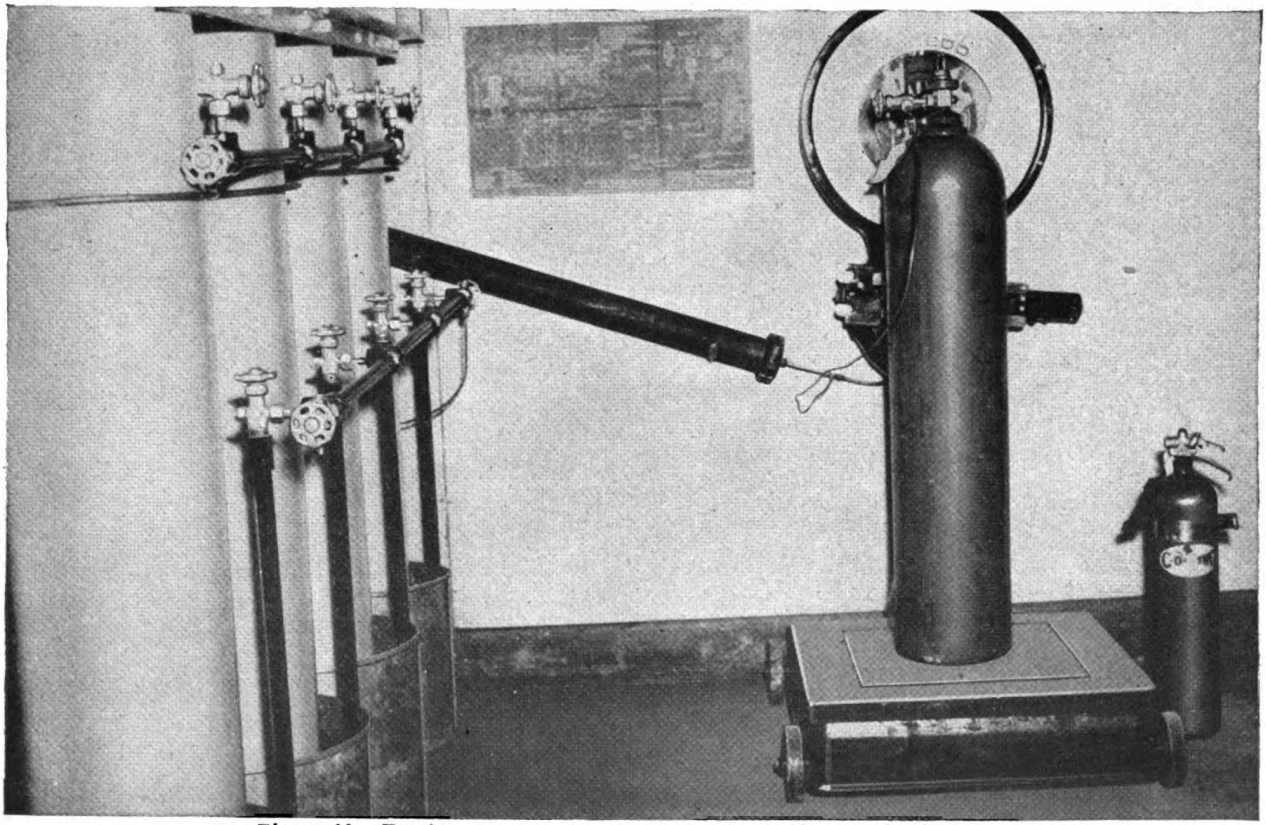


Figure 38. Dry-ice converter in operation. (Stock No. 66–3520.500–000.)

(2) *Extinguisher.* (*a*) See that lead wire seal on extinguisher is unbroken. If seal is broken, weigh, recharge if necessary, reseal, and return to proper position.

(*b*) Check to see that plastic seal is in place on pressure-release disk. A missing plastic seal may indicate a ruptured safety disk and an empty extinguisher. If seal is missing, weigh, install new safety-disk cover, recharge if necessary, reseal, make proper entry on tag, and return extinguisher to service.

(*c*) Make sure extinguisher is not subject to high temperatures or located in direct rays of sun. Relocate or shield from sun's rays if necessary.

(*d*) Check hose for deterioration or weakness. Replace with new hose secured from manufacturer if necessary.

(3) *Records.* (*a*) Make proper entry on extinguisher tag. Replace tag if missing.

(*b*) Make proper entries in record books of fire department.

b. SEMIANNUALLY. Perform the following services semiannually:

(1) *General.* Make the general checks described in paragraph 35*b*(1).

(2) *Extinguisher.* Weigh extinguisher to insure full charge. Recharge units if less than 90 percent of net capacity is present.

Caution: Recharging must be done only by qualified personnel. Extremely high pressures are encountered and every care must be taken to insure secure connections, adequate valves, and safe practices. On disk type valves use only the disk recommended by the manufacturer. Lubricate running gears on wheel type extinguishers.

(3) *Records.* If latest date on cylinder neck is over 5 years old, have hydrostatic test of cylinder made by manufacturer, supplier of carbon dioxide gas, or agency with proper personnel and equipment.

Section VII. MISCELLANEOUS EXTINGUISHERS

46. Types

The special types of extinguishers below have had limited distribution, although they are not Army-wide items of issue.

a. LOADED-STREAM TYPE. Loaded-stream extinguishers use water as the basic extinguishing agent, with metallic salts added to increase the extinguishing value. A carbon dioxide cylinder supplies the expelling force.

b. NONFREEZE TYPE. Nonfreeze extinguishers use water as the basic extinguishing agent with a nonfreeze compound, usually calcium chloride, added. The expelling force is supplied by a carbon dioxide cylinder.

c. DRY-POWDER TYPE. Dry-powder extinguishers use a compound of bicarbonate of soda as the extinguishing agent; other materials are added to prevent caking and moisture absorption. Expelling force is supplied by a carbon dioxide cylinder.

47. Maintenance

Detailed instructions on preventive maintenance procedures are contained in the manufacturers' manuals and on extinguisher instruction plates. Follow these instructions closely to keep extinguishers in operating condition.

Section VIII. WINTERIZATION OF FIRE EXTINGUISHERS

48. General

Protecting extinguishers from freezing is extremely important and must be carefully studied and thoroughly understood by all fire department personnel charged with care and maintenance of equipment.

a. CARBON TETRACHLORIDE TYPE. The extinguishing agent recommended for use at War Department installations has a carbon tetrachloride base with ingredients added to depress the freezing point to —50° F. Normally, this is sufficient for fire service requirements. If lower temperatures are likely to be encountered, take suitable action to protect extinguishers against freezing. Method of further depressing freezing point of carbon tetrachloride fire extinguisher liquid is prescribed in Army Air Forces Technical Order 03–45B–2.

b. CARBON DIOXIDE TYPE. Carbon dioxide extinguishers normally do not require winterization. However, extreme temperature requirements peculiar to some services may require the addition of nitrogen as an expelling force. When adding nitrogen, conform to directives established by the using agency. Method of winterizing carbon dioxide fire extinguishers is prescribed in Army Air Forces Technical Order 03–45C–11.

c. HAND-PUMP-TANK TYPES. Hand-pump types discussed in this manual freeze at temperatures below 32° F., unless they are treated with nonfreeze solutions.

d. SODA-ACID AND FOAM TYPES. Soda-acid and foam types discussed in this manual freeze if temperatures fall below 32° F. They cannot be treated with nonfreeze solutions because their contents depend on the reaction of certain chemicals to generate pressure for discharge. Addition of any nonfreeze solution affects the chemicals, making them inoperative.

49. Calcium Chloride

The prescribed chemical for lowering the freezing point of water is calcium chloride. The chart below gives the quantity of calcium chloride per gallon of water to obtain the freezing point indicated. In preparing nonfreeze solutions, allow for the increase in volume when calcium chloride goes into solution. *Example:* 10 pounds of calcium chloride dissolved in 2 gallons of water produce 2½ gallons of solution, while the increase in volume for a weaker solution is proportionately less.

FREEZING POINTS OF CALCIUM CHLORIDE AND WATER MIXTURES

(75 percent commercial calcium chloride)

Pounds per gallon of water	*Freezing point (°F.)*
1.5	+31
2	+14.4
2.48	+ 7.5
2.96	— 1.4
3.5	— 8.7
4.08	—21.8

Caution: *Never use more than 5½ pounds of calcium chloride per gallon of water.* More than this amount raises the freezing point of the solution instead of lowering it. Nonfreeze solutions in untreated galvanized-steel extinguishers corrode the metal. Before nonfreeze solutions are added to hand extinguishers, paint the tank interior heavily with two coats of asphaltum-base paint to delay corrosive action and prolong extinguisher life.

CHAPTER 4

FIRE HOSE

Section I. GENERAL

50. Scope

This chapter describes fire hose used at military installations, outlines causes and treatment of hose injuries, and gives detailed instructions on hose inspection and maintenance. Records required for proper hose care are also covered.

51. Safety

Discharge lines handled under high pressure are always potentially dangerous. Accidents caused by discharge lines can best be prevented by thorough training of fire department personnel in use of high-pressure hose lines and periodic and complete inspection of hose and hose-line equipment.

Section II. HOSE TYPES AND THEIR USES

52. General

Four types of hose are used by the Army: cotton-jacket rubber-lined hose; rubber-covered rubber-lined hose; rubber-covered rubber-lined wire-reinforced hose; and unlined linen hose. All are issued in sections fitted with a male-threaded coupling at one end and female-threaded coupling at the other. Some suction hose is made with female-threaded couplings on both ends of the section. Hose lines can be made up in any desired length by coupling individual sections together.

53. Couplings

Hose couplings (fig. 39) are designed to permit rapid assembly of hose lines.

a. MALE COUPLINGS. Male couplings consist of a single piece of brass or malleable iron threaded on one end. The hose is fastened inside the other end, the bowl or tailpiece, by an expansion ring placed inside the hose and expanded to lock the hose against the coupling. A special expansion gasket between hose and coupling insures a watertight joint.

b. FEMALE COUPLINGS. Female couplings consist of a tailpiece and a female-threaded brass swivel. The swivel is fastened to the coupling by a special interlocking retainer called a "still" thread which allows the swivel to turn freely on the tailpiece. A gasket between swivel and tailpiece prevents leaks. Projecting pin, rocker, or guard lugs on the swivel and on the male coupling make it easier to tighten connections. Female couplings are attached to hose in the same way as male couplings.

54. Cotton-jacket Rubber-lined Hose

Cotton-jacket rubber-lined hose consists of a single or double woven jacket lined with a three-, four-, or five-ply lap-jointed rubber tube. The smooth inner surface of the rubber tube reduces friction losses and therefore increases volume of water delivered by the hose. The cotton jacket increases strength, durability, and flexibility of the hose. Tube and jacket are bonded by inserting a backing sheet between them and then vulcanizing. The backing is forced into spaces in the woven jacket, giving added strength and a firm bond. This type hose is used on standard fire pumping apparatus. It is supplied in 1½- and 2½-inch sizes for discharge hose and 3½- and 4-inch sizes for suction hose. If unlined linen hose is not available, 1½-inch single-jacket hose can also be used for standpipe hose.

55. Rubber-covered Rubber-lined Hose

Rubber-covered rubber-lined hose consists of at least three plies of cotton braid or four plies of cotton fabric covered inside and outside with rubber layers. It is less flexible than cotton-jacket hose but can withstand higher pressures. When reinforced with spirally wound wire molded into the rubber and fabric it can withstand even higher pressures or suction without bursting or collapsing. Wire-reinforced hose is principally used in the fire service as hard suction

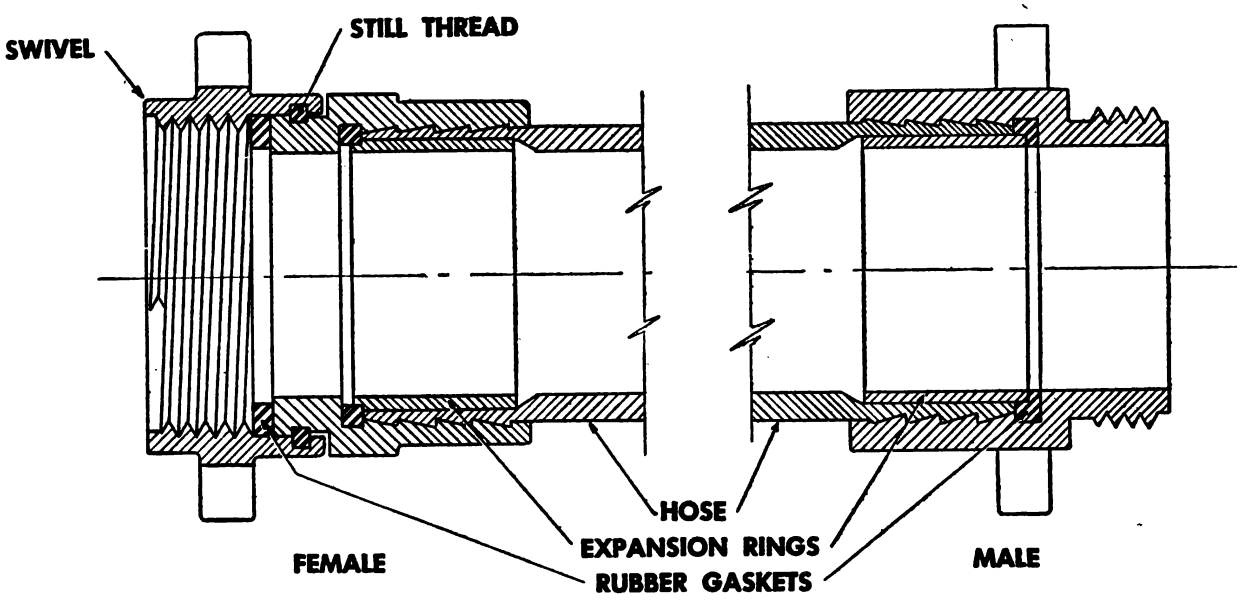


Figure 39. Fire-hose couplings.

hose. Rubber-covered rubber-lined hose is supplied in 1-, 3-, 4-, and 4½-inch sizes. The 1-inch size is used for booster lines on fire trucks and discharge lines on 40-gallon soda-acid chemical engines. The 3-, 4-, and 4½-inch sizes are hard suction hose. The 3-inch size is used on the class 300 brush truck and class 325 fire truck, the 4-inch size on the class 500 truck, and the 4½-inch size on the class 750 truck.

56. Unlined Linen Hose

Unlined linen hose consists of one or two jackets of woven linen without rubber lining or cover. It is issued only in the 1½-inch size for use on standpipe systems.

Section III. CAUSES OF HOSE INJURY

57. Mechanical Injury

a. DRAGGING. Dragging hose along the ground results in cuts, abrasions, punctures, and damaged coupling threads or lugs. Carry hose correctly at all times.

b. PULSATION AND VIBRATION. Pulsations in the pump cause suction and discharge hose sections to vibrate, chafing hose jackets against surfaces they touch. If surfaces are rough or have sharp edges, serious hose injury results. Hose closest to the engine is chafed most severely; farther away, pump vibration is absorbed by elasticity of the hose. Vibration may be almost imperceptible, yet may weaken hose so much that failure occurs in a relatively short time. To prevent chafing—

(1) Insert chafing blocks between hose line and ground.

(2) If chafing blocks are not available, place burlap, gunnysack, or rope cushions around hose at affected points.

c. EXCESSIVE PRESSURES. Hose can be damaged by improper operation of the shut-off nozzle. Closing the shut-off nozzle quickly causes a sudden increase in pressure which may rupture the hose. If the nozzle is opened quickly, the operator may lose control of the hose and injury to hose or personnel may result.

d. DRIVING OVER HOSE. One of the commonest causes of hose injury is driving heavy equipment across hose lines. Serious damage is less likely when hose is under good pressure, but when it is empty or under low pressure the jacket may be separated from the lining or the hose may be ruptured or torn from the coupling. This type of damage can be prevented by any of the following measures:

(1) Build two standard bridges (fig. 40) and carry them on truck at all times. After hose lines are stretched, set bridges across hose, about 3½ to 4 feet apart. If standard bridges are not available, build an expedient bridge with materials found at scene of fire. A simple bridge consists of planks

on each side of hose, thick enough to keep wheels from striking hose as they cross.

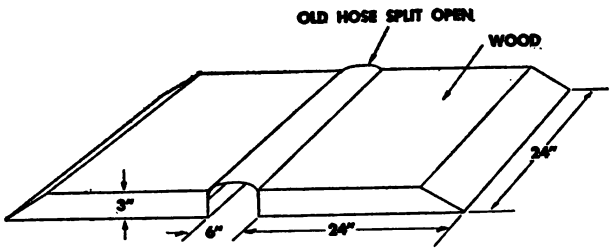


Figure 40. Standard hose bridge.

(2) Whenever possible, stretch the first hose lines from hydrant on same side of road as fire. Lay lines parallel to curb, but not so close to curb that acid or oil floating down the gutter may come in contact with them.

(3) If a street or areaway must be crossed, stretch hose parallel to curb on same side of street as hydrant, up to a point opposite fire, then across the street. Thus equipment that follows need not ride over hose unless it must pass to far side of building.

e. MISHANDLING FROZEN HOSE. In winter, hose is often damaged by rough handling. When frozen, cotton fibers are weakened and warp threads, which run lengthwise of the hose, may break if hose is not handled carefully. If hose has frozen to street, free it by carefully chopping away the ice beneath it. *Do not* remove ice that remains attached to hose. Place hose in truck with least possible bending or forcing and take it back to station. After frozen hose thaws out, clean it and stretch it out to dry. (See par 64.)

Caution: Handle frozen hose as little as possible.

f. DROPPING HOSE. Carry fire hose carefully to avoid dropping it. Most damage to couplings occurs when hose is dropped. If possible, carry hose at the couplings.

58. Heat Injury

a. BURNING. Fire hose is often unavoidably burned at fires. Inspect carefully all hose that has been close to the fire. If more than one-third of any section is burned, turn the entire section in for salvage. If less than one-third is burned, cut out damaged portion and recouple the balance. (See par. 66.)

b. HOT LIQUIDS. Hot liquids penetrate the cotton cover and loosen the rubber lining, weakening the hose. For correct methods of cleaning hose, see paragraph 64.

c. STORAGE. For proper care of stored hose to prevent heat damage, see paragraph 63.

59. Chemical Injury

Chemical injury cannot always be prevented, especially during fire at chemical depots or warehouses. In addition, it is almost impossible to know whether water flowing out of a burning building contains injurious chemicals. Hose is therefore frequently damaged by exposure to chemicals without the source of exposure being known. To guard against chemical damage, apply the corrective measures described below whenever exposure to chemicals is suspected.

a. ACIDS. Acid, even in dilute solution, damages fire hose irreparably by destroying the hose jacket. Some acids brown the hose jacket instantly; others turn the cotton fiber to powder.

(1) Acid may come in contact with fire hose in a number of ways.

(*a*) Acid may be spilled on the fire-station floor when extinguishers are being recharged or when batteries are being tested with a hydrometer.

(*b*) Hose may be damaged by acid at fires in automobile repair shops, battery stations, storage warehouses, garages, hangars, and processing, salvage, and manufacturing shops.

(*c*) Damage may result when hose is shipped along with acid containers, such as storage batteries and carboys, which may leak from rough handling.

(2) When acid contact with hose is suspected, examine hose closely as soon as possible for brown or powdery spots. Wash hose which may have been exposed to acid promptly and thoroughly with baking soda solution.

b. GASOLINE. Gasoline causes rapid deterioration of the rubber lining. In addition, even a small amount of gasoline on the jacket works its way through and dissolves the cement holding the lining to the jacket, freeing the lining. When this hose is used, the lining may tear apart and pile up in one end of the hose, causing a partial or complete stoppage.

c. OILS AND GREASES. Thin oils and greases, which go through the hose jacket readily, are more serious than the thicker oils and greases, which tend to stay on the outside. Oils that soak through the jacket reach the rubber lining and spread along the rubber, destroying it rapidly.

d. PAINT AND PAINT THINNER. Paints are harmful to fire hose because of the oils they contain. Fire hose must therefore be protected from paint as much as from grease and oils. Do not use paint to mark fire hose; instead, stencil hose with indelible ink, using only enough ink on the brush to color the hose surface. When hose is used in paint or varnish storeroom fires, take particular care to keep it out of paints, grease, and similar materials.

e. STRONG SOAPS. Never use strong soaps for cleaning hose. The chemical content of strong soap tends to weaken the cotton cover and deteriorate the rubber lining. For proper cleaning procedure, see paragraph 64.

Section IV. INSPECTION AND PREVENTIVE MAINTENANCE

60. General

a. MAINTENANCE RESPONSIBILITY. The fire chief is responsible for maintenance of all fire hose. The various phases of hose maintenance are carried out by all fire-fighting personnel under his direction.

b. IMPORTANCE. Hose maintenance consists of periodic inspection and servicing of hose in use, care of hose in storage, and continuing examination of all hose for signs of injury or deterioration. (See sec. III of this ch.) Fire department personnel must be trained to recognize the importance of hose maintenance and to apply instructions in this manual completely. Improper or incomplete hose maintenance shortens hose life and may result in hose failure at a critical time.

c. BASIC PRINCIPLES. Hose maintenance is complicated by the fact that hose components present entirely dissimilar problems. The cotton jacket and rubber lining deteriorate with age, whether or not the hose is used. Rubber deterioration can be delayed if the lining is kept moist. The jacket, on the other hand, deteriorates rapidly if kept wet since the moisture causes mildew, a fungus growth that destroys cotton fiber. Keeping the rubber moist and the cotton clean and dry requires periodic handling which may damage the hose couplings. Couplings do not deteriorate and are not affected by water; however, they are made of soft metal and rough or careless handling can damage them severely. Methods of meeting the problems in hose care are discussed below.

61. Inspecting Rubber-lined Hose

Inspect cotton-jacket rubber-lined hose and rubber-covered rubber-lined hose daily, after each use, monthly, and semiannually, using procedures outlined below.

a. DAILY INSPECTION. Make the following inspections every day:

(1) Check hose on trucks to see that it is dry and correctly loaded in hose body, hose basket, or on hose reel.

(2) Inspect hose on drying rack to see that it is correctly laid out.

(3) Make sure drippings from ends of hose on the upper rack are not falling on hose below. Drippings may contain a mild acid formed by combination of water and the sulfur in the rubber lining, which would destroy cotton jackets. For proper construction of drying racks to prevent damage from dripping, see paragraph 64*b*.

b. INSPECTION AFTER USE. On return to the station after a fire, inspect and clean all hose and couplings as follows:

(1) *Two and a half-inch cotton-jacket rubber-lined hose.* (*a*) Remove from the truck all 2½-inch cotton-jacketed rubber-lined hose that was used or is wet. Clean hose carefully, examine couplings ((4) below), and place hose on drying racks.

(*b*) If necessary, take remaining hose from truck and clean and dry truck hose compartment. Couple clean dry hose, inspecting all couplings and gaskets as connections are made, and reload hose compartment.

(2) *Rubber-covered booster and hard suction hose.* Remove rubber-covered booster and hard suction hose from rack, basket, or reel. Wipe hose clean and replace it on truck.

(3) *Cotton-jacket rubber-lined soft suction hose.* Wash all used cotton-jacket rubber-lined soft suction hose; for procedure see paragraph 64. Lay out hose to dry near truck so it can be replaced on truck immediately if needed.

(4) *Couplings.* (*a*) Examine coupling threads; if injured or defective, replace coupling. (See par. 66.)

(*b*) Clean dirty or jammed couplings, using soapy water to loosen hardened lubricant. Lubricate female coupling by immersing it in a mixture of mild soap and water and allow to dry. Do not use

strong soap, chemicals, gasoline, oil, or grease to clean or lubricate couplings because they may injure hose jacket or lining.

(*c*) Inspect gaskets and replace them if they are worn or damaged. Make sure gaskets do not project into waterway, particularly at nozzle coupling, because this will cause a ragged stream.

c. MONTHLY INSPECTION. Remove all 1½- and 2½-inch cotton-jacket rubber-lined hose that has been on a truck continuously for 30 days. Examine it visually and if it is satisfactory, repack it in hose body. When rolling hose, lay it out on a clean floor and start roll at male coupling. Take care not to have too sharp a fold at coupling, and make sure folds are not made at the same points as before. If hose is rolled or packed with folds always at the same point, it will crack.

d. SEMIANNUAL INSPECTION. Inspect all discharge and suction hose every 6 months, using the procedure below.

(1) Make a hydrostatic test of all hose to find whether it can safely withstand operating pressures. Test discharge hose in single 50-foot lengths or in lines up to 300 feet; the latter is recommended. Use the following test pressures:

Hose	*Pressure (psi)*
1-inch rubber-covered	200
1½- and 2½-inch single-cotton-jacket rubber-lined	150
1½- and 2½-inch double-cotton-jacket rubber-lined	200
3- and 4-inch double-cotton-jacket rubber-lined soft suction	100
3-, 4-, and 4½-inch rubber-covered hard suction	100

(*a*) Test cotton-jacket rubber-lined hose and rubber-covered rubber-lined chemical and high-pressure hose as follows:

1. Attach suction hose between hydrant and pumper.
2. Attach hose to be tested to discharge gates of pumper.
3. Partially close discharge nozzle at end of hose and open discharge gate at pump.
4. When water flows freely, close discharge nozzle at end of hose.
5. Place pump in operation and increase to required test pressure given in list above.

(*b*) Test rubber-covered rubber-lined suction hose as follows, using one or two lengths at one time.

1. Drain pump.
2. Close drain cocks and discharge valves.
3. Remove suction cap and connect hose.
4. Place cap on other end of hose after checking gasket.
5. Using the primer, create a minimum vacuum of 23 inches of mercury.
6. Test hose under pressure, using procedure in (*a*) above.

(2) Immediately following the pressure test, idle the fire pump down, allowing hydrant pressure to remain in the hose, and make the following checks:

(*a*) Inspect cotton jacket or rubber covering of each hose length for—

1. Scorches, burns, or heat injuries.
2. Abrasions, lumps, or blisters.
3. Moisture on outer jacket which may indicate leakage.

(*b*) Examine hose close to couplings for leaks.

(*c*) Check over entire hose for—

1. Creases or breaks caused by sharp bends.
2. Damage from freezing.
3. Damage from chemicals or acids.
4. Injury from oil or grease.

(3) Shut off water, disconnect each length of hose, and inspect couplings and hose lining.

(*a*) Check couplings for—

1. Damage to threads.
2. Bent or misshapen couplings.
3. Binding swivels.
4. Injury to expansion rings.
5. Loose couplings.
6. Broken or damaged lugs.
7. Cracked, broken, or poorly fitting washers.
8. Dirt or obstructions in washer grooves.

(*b*) Examine hose lining for—

1. Presence of oil or grease.
2. Cracks or checks.
3. Hardness due to age.
4. Signs of separation from inner jacket or fabric.

62. Inspecting Unlined Linen Hose

Inspect unlined linen hose weekly and annually as outlined below.

a. WEEKLY INSPECTION. Make the following checks weekly:

(1) Check for leakage of hose valves.

(2) Check automatic drip cocks at valves which prevent water from reaching linen hose.

b. ANNUAL INSPECTION. Inspect all linen hose yearly as follows:

Examine nozzles, couplings, washers, and hose for damage, corrosion, and deterioration.

63. Storing Hose

Proper storage of unused hose is an important part of hose maintenance. To prevent rapid deterioration, store hose in a clean, dry, well-ventilated place, out of direct sunlight and away from heating pipes and radiators. If storage place is damp or poorly ventilated, mildew forms and destroys cotton jacket. Heat or sunlight causes rubber covers and linings to become hard and brittle.

a. MAINTENANCE PROCEDURES. To protect stored hose—

(1) Unroll all stored hose at least once every 60 days and flush it with clear water.

(2) Dry the jacket thoroughly and re-roll hose, following instructions on rolling in paragraph 61*c*.

(3) Store the rolls flat or in upright position.

b. HOSE RACK. The storage rack in figure 41 can be built locally to accommodate 1,000 or more feet of hose. Make the rack strong enough to hold loads in excess of 1,000 pounds, using skeleton construction to permit maximum ventilation around hose rolls.

64. Cleaning Hose

Since hose which is properly cleaned and dried is less likely to deteriorate, clean hose as frequently as necessary. Never store dirty hose.

a. WASHING. (1) Lay hose on a clean surface and brush all dirt and foreign matter off jacket.

(2) If hose is spotted with oil, dip it in cold water to set the oil, wash with mild soap, then rinse thoroughly with clean water. Do not use strong soaps or chemicals.

(3) While washing, look for damaged jackets and couplings. Set aside and tag damaged sections for closer inspection.

b. DRYING. (1) *Rubber-lined hose.* Place rubber-lined hose on drying rack (fig. 42), making sure that ends of hose on upper rack do not drain onto ends of hose below. Change position of hose frequently so parts touching the rack can dry. Keep hose out of direct rays of the sun; do not place it on ground or concrete outside fire station to dry. Do not pile lengths of hose on top of other hose; free circulation of air around each hose section is essential to proper drying.

(2) *Unlined linen hose.* Hang up unlined linen hose or place it on racks to allow all water to drain out. Continue drying in a warm place with unrestricted circulation of air around hose until hose is absolutely dry inside and out.

Caution: Unlined linen hose is especially susceptible to rot and mildew. Even a slight amount of moisture in the hose can cause rapid deterioration. Therefore, check for moisture carefully when inspecting linen hose, and always dry linen hose thoroughly.

65. Preventing Hose Injury

Unless hose is handled and used properly, damage is unavoidable. See section III of this chapter for causes of hose injury and means of preventing them.

Section V. COUPLING REPLACEMENT

66. Coupling Replacement

Fire department personnel are responsible for replacing damaged hose couplings and for salvaging damaged hose by cutting out defective portions and recoupling the remaining sections. Generally not less than two-thirds of a section should be recoupled, although shorter lengths may be used occasionally for special purposes. Remove and replace couplings as follows:

a. Place coupling in vise and cut through expansion ring with chisel or other sharp tool.

b. Remove expansion ring, hose, and rubber gasket.

c. Cut off damaged portion of hose with sharp knife. Make sure end of hose is square and smooth.

d. Place expansion gasket in coupling.

e. Fit expansion ring inside hose, flush with hose end.

f. Insert hose in coupling tailpiece. Make sure hose is flush with gasket and shoulder of coupling.

g. Using an expansion tool, expand ring until it locks hose inside coupling. Several types of expansion tools are manufactured. Directions for use and specifications for pressures are published by each manufacturer. Follow these directions and specifications exactly.

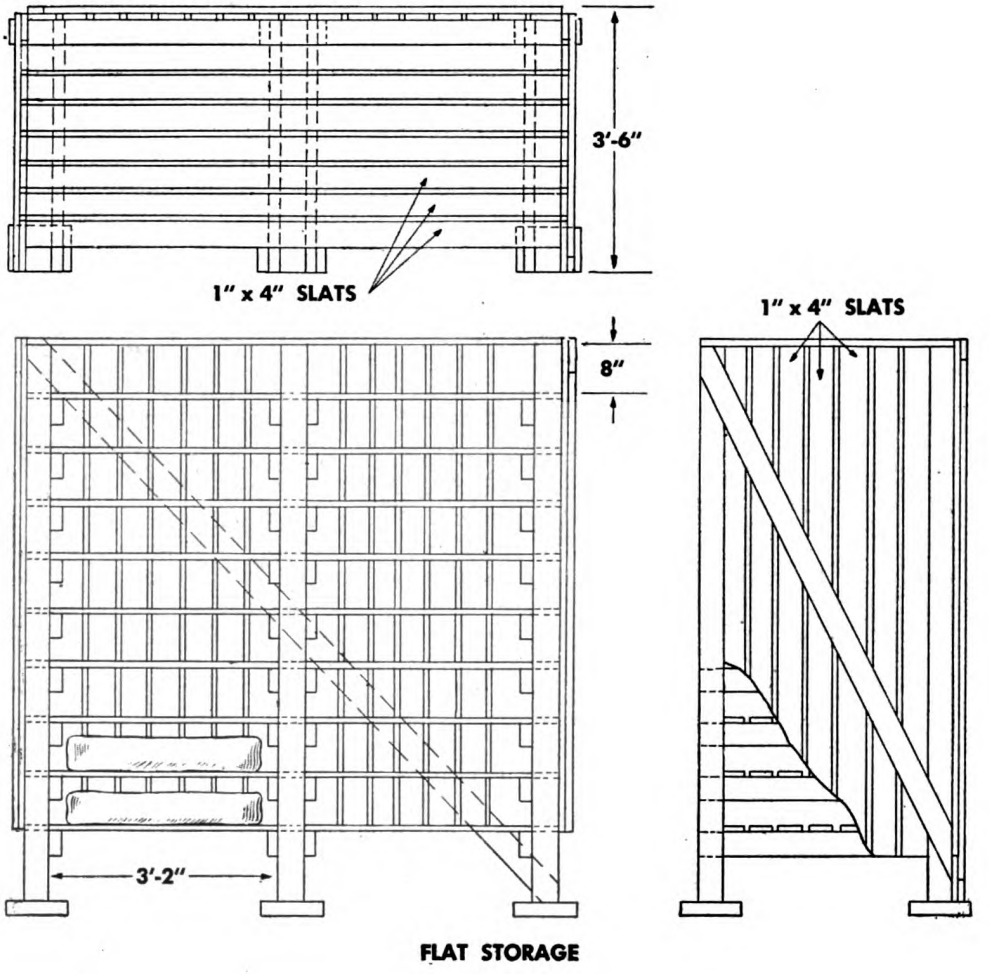


Figure 41. Hose storage rack.

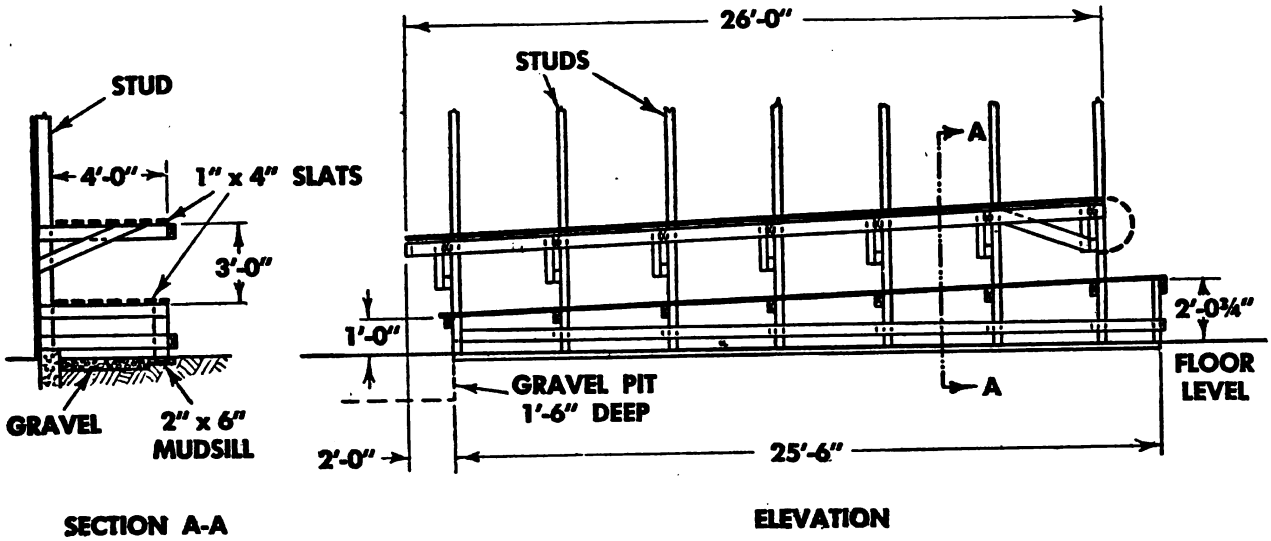


Figure 42. Hose drying rack. (Lower rack is 2 feet shorter than upper rack so drippings from hose on upper rack cannot fall on hose below.)

Section VI. RECORDS

67. Hose Records

Complete records of performance, maintenance, and testing are a basic part of any maintenance program. The minimum records required for fire hose are kept by the fire chief. As each length of hose is received, an identifying number is stamped on its coupling. At the same time, a record card is set up showing hose number, type of hose, date received, and manufacturer. Thereafter, operating and maintenance data are entered regularly on the record card. Entries include date hose is tested, test pressures, and remarks on the test; explanation of any hose failure, the cause, and the date; date of recoupling; and details of other unusual maintenance. Hose record cards are kept in the fire station where they are available for immediate reference. In addition, copies of test reports may be kept in the daily department records.

CHAPTER 5

MISCELLANEOUS EQUIPMENT

68. Scope

Despite their importance in fire department operations, fire-fighting tools, fittings, appliances, and other miscellaneous equipment are likely to be neglected or abused. This chapter outlines basic guides to maintaining miscellaneous fire-fighting equipment. More detailed maintenance procedures can be prepared at each post.

69. Maintenance Guides

Keeping miscellaneous fire-fighting equipment in good condition is a continuous process requiring daily inspection and frequent servicing. Basic considerations are discussed below.

a. GENERAL. Never use fire-fighting tools, equipment, and appliances for any purpose except fire prevention or control.

b. EDGED TOOLS. Keep edged tools sharp and free from nicks and rust.

(1) Sharpen tools on a whetstone, so temper will not be drawn from the blade. Do not use an emery wheel.

(2) Keep original contour of blade by grinding entire face of blade rather than sharpening only the edge.

(3) Remove all rust and protect metal with a thin film of oil.

(4) Since metal exposed to extremely cold temperatures becomes brittle and subject to breakage, avoid leaving tools in the open unnecessarily.

c. LADDERS. (1) Carefully remove paint from fire ladders, then apply a coating of clear varnish.

(2) If ladders have splinters or rough edges, smooth them with sandpaper, then apply varnish.

(3) Replace ladders if beams are cracked or split. If rungs are broken or weakened, replace them with new hickory or ash rungs. Use rods to tighten loose rungs.

(4) Examine ladder for damage at point where dogs or pawls drag across rungs.

(5) Inspect rope or halyard closely and replace if there are signs of weakness.

(6) Oil folding-ladder hooks. Replace them if necessary.

(7) Check bolts or rivets securing pawls or hooks to ladder, and tighten as needed.

Caution: Limit the number of men allowed on a ladder at one time. Rule of thumb for safe load: one man for each 10 feet of ladder length.

d. WOOD-HANDLED TOOLS. (1) Remove paint from tool handles and treat by rubbing with linseed oil.

(2) Inspect handles carefully for cracks or splinters. Replace cracked handles. Smooth rough handles with sandpaper.

(3) Secure loose heads with wedges or rivets.

Caution: Do not use wood-handled tools as levers for heavy prying, except in emergency.

e. HOSE APPLIANCES. (1) Take care not to drop threaded appliances. They are usually made of comparatively soft metal and require careful handling to avoid damage.

(2) Clean threads by washing with soapy water or brushing with a steel brush.

(3) When making a connection, make sure female couplings have a sound gasket.

(4) Replace gaskets when they become cracked or grooved.

(5) Eliminate nozzle leaks by tightening bushings or installing new packing.

Caution: Use only spanner wrenches to tighten leaking couplings. Do not lubricate couplings with lubricating oil.

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